Volume 19 Study G-I-R

STATE OF ALASKA

Jay S. Hammond, Governor

Annual Performance Report for

INVENTORY OF HIGH QUALITY RECREATIONAL FISHING WATERS IN SOUTHEAST ALASKA

by

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Inventory and Cataloging

Job No. G-I-R
Inventory of High Quality Recreational Fishing Waters in Southeast Alaska

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RESEARCH PROJECT SEGMENT

State: ALASKA Name: Sport Fish Investigations of Alaska

Project No.: F-9-10

Study No.: G-I Study Title: INVENTORY & CATALOGING

Job No.: G-I-R Job Title: Inventory of High Quality Recreational Fishing Waters in Southeast Alaska

Period Covered: July 1, 1977 to June 30, 1978

ABSTRACT

Limnological investigations and recreational analyses were conducted on Ella, Manzanita, Turner, and Wilson lakes and Duncan Creek in an attempt to determine the relationship of physical, chemical, and biological characteristics to fish production and to protect high-quality fishing and recreational areas from undesirable development.

Intensive limnological and fishery investigations were conducted on the four lakes throughout the summer. Duncan Creek and Saltchuck was investigated during two, one-week periods. Recreational analyses were conducted on all systems.

Ella, Manzanita, Turner, and Wilson lakes are large (624-1,270 hectares) oligotrophic lakes. Mean depth ranges from 30.3 m (Turner Lake) to 70.2 m (Wilson Lake). Chemical analyses indicate that Ella, Manzanita, and Wilson lakes have the highest conductivity (47-68 micromhos) of lakes analyzed to date in southeast Alaska.

All lakes have cutthroat trout, *Salmo clarki* Richardson, and kokanee, *Oncorhynchus nerka* (Walbaum), populations and are popular high-quality recreational fishing areas.

Cutthroat trout from Wilson Lake had the slowest growth rate but the greatest weight at any given length of all lakes studied. Condition factors of cutthroat trout from Wilson Lake averaged 1.05, the highest of all lakes studied. Cutthroat trout from Manzanita Lake were longer at any given age but had the lowest weight at any given length. Condition factor of cutthroat trout from Manzanita Lake was 0.88, much lower than Wilson Lake at 1.05 or Turner Lake at 1.02. Cutthroat trout from Manzanita Lake appear to have characteristics of both cutthroat and rainbow trout, *S. gairdneri* Richardson. Condition factor of cutthroat trout from Ella Lake was lowest at 0.84.

Condition factors of Dolly Varden, Salvelinus malma (Walbaum), was lowest in Wilson Lake (0.85) and highest in Ella Lake (1.35), just the opposite from the trend in cutthroat trout.

Stomach content analysis of cutthroat trout showed that they fed heavily upon kokanee once they obtained a size of about 240 mm. The second most important food source was Chironomidae adults and pupae.

Analyses of kokanee stomachs showed that kokanee fed primarily on insect larvae and pupae and recently emerged adults. Fish were commonly seen schooled off inlet deltas where they were gathering stream drift organisms. Only 2 of 34 fish examined had fed on Cladocera.

Investigation of Duncan Creek and Saltchuck showed this system to be a very important area for coho salmon, O. kisutch (Walbaum); cutthroat trout; and rainbow trout. Coho salmon and rainbow trout were found throughout the entire stream system surveyed. The rearing rainbow trout are thought to be steelhead trout, S. gairdneri Richardson, presmolt; but the presence of adult steelhead trout has not been confirmed. Rearing coho salmon were abundant in the saltchuck. Adult cutthroat trout and Dolly Varden were abundant in the lower section of Duncan Creek. Schools of cutthroat trout were seen feeding in the saltchuck rapids area.

BACKGROUND

Limnological investigations have been conducted in several lakes in Southeast Alaska (Schmidt, 1974; Schmidt and Robards, 1975; Schmidt, 1976 and 1977). One continuing objective of this project is to determine the relationship of physical, chemical, and biological characteristics to fish production.

The Alaska Department of Fish and Game, Sport Fish Division, has long attempted to obtain additional protection for high-quality fishing waters. In 1972 the Alaska Department of Fish and Game made an official request to the forest supervisor of the Tongass National Forest to give special consideration to 18 identified high-quality watersheds. This investigation was conducted in an attempt to further quantify the recreational value of one of the previously mentioned 18 watersheds (Duncan Creek) and to examine the limnological relationships in four of the large cutthroat trout-kokanee lakes in southeast Alaska.

RECOMMENDATIONS

Management

1. No undesirable development should be allowed in Ella, Manzanita, Wilson, or Turner lake areas.

2. Measures should be taken to protect Duncan Creek and Saltchuck from undesirable development. No further development should be allowed near the creek or saltchuck.

Research

1. Specimens of cutthroat trout from Manzanita Lake should be collected for taxonomic identification.

2. Trophy fish coming from Wilson Lake should be aged to further define age-length relationship.

3. The importance of Duncan Saltchuck as an overwintering area for cutthroat trout should be evaluated.

4. Duncan Creek should be checked in early spring to document the presence of adult steelhead trout.

5. Kokanee should be collected from Wilson Lake for age-growth analysis.

OBJECTIVES

1. To determine the relationship of physical, chemical, and biological characteristics of selected lakes to fish production.

2. To identify and protect from undesirable development high-quality recreational fishing waters in southeast Alaska.

3. To determine the recreational fishing potential of Ella, Manzanita, Turner, and Wilson lakes and Duncan Canal Saltchuck.

TECHNIQUES USED

Relationship of Limnological Characteristics to Fish Production

Limnological relationships existing in four major lakes were investigated. These included Turner Lake near Juneau and Ella, Manzanita, and Wilson lakes near Ketchikan.

Intensive limnological and fishery investigations were conducted on each lake. Each of the four lakes was sampled every third week. In addition, a field collection trip was made to each lake during the fall turnover period to gather comprehensive water quality data. Sampling stations were established at approximately the deepest portion of each lake. Vertical profiles of temperature and specific conductance were recorded at each station. Water samples for comprehensive chemical analyses were collected and preserved at each station. Field chemical analyses, including alkalinity titrations, were conducted according to Standard Methods (1971). Comprehensive chemical analyses on preserved samples were conducted by the Alaska Department of Environmental Conservation laboratory in Douglas, Alaska.

Bathymetric maps were prepared for each lake. A recording fathometer was used to record depth contours on transects crossing each lake. The depth contours were transferred to bathymetric maps, and morphometric data were calculated from these maps.

Zooplankton were collected biweekly by making duplicate vertical tows from the lake bottom with each of two nets. Nets used were 0.5 meters diameter and 3 meters long. Straining cloth of the No. 153 Nitex net had aperture of 153 microns and 45% open area. Plankton were identified and counted. Dry and ash weight of plankton were determined gravimetrically. Efficiency of nets was not accounted for in calculations. Thermal profiles and Secchi disc readings were taken in conjunction with plankton tows.

Stream drift organisms were collected biweekly by placing two nets in the main inlet. Nets used were 12 inches square, 3 feet long, made with Nitex with pore size of 280 microns and 45% open area. Benthos were preserved and later identified and enumerated in the laboratory.

Bottom fauna were collected by dredging with an Ekman 6-inch dredge. Bottom samples were washed through three screens, the finest having 28 meshes per inch. Organisms were preserved in 70% ethyl alcohol or frozen until laboratory analysis.

Rearing and spawning areas of inlet and outlet streams were mapped. Adult and juvenile fish were collected by hook and line, gill nets, and fry traps. Age, growth, and food habits of fish in the lakes were determined from fish collected throughout the study period.

Evaluation of High-Quality Recreational Fishing Waters

The recreational potential of each of the four lakes and Duncan Saltchuck was evaluated. Information evaluated included present and future recreational opportunity and importance, proximity to other recreational areas, uniqueness of the area, ability of the system to support a viable fishery, accessibility, and aesthetics.

Two 1-week investigations were conducted on Duncan Creek and estuary. The sport fishing potential of the saltchuck and stream was documented. Extensive creek mapping and sampling of rearing fish populations was accomplished.

FINDINGS

Relationship of Limnological Characteristics to Fish Production

Morphometry:

The depth, size, and shape of lakes strongly influence physical and chemical conditions which prevail in them. Since physical and chemical parameters limit species composition and abundance of organisms, it is essential to study the morphometric features of lakes. Bathymetric maps of Ella Lake (Figure 1), Manzanita Lake (Figure 2), Turner Lake (Figure 3), and Wilson Lake (Figure 4) were prepared from sounding data. Morphometric data for these lakes are presented in Tables 1 through 4. All lakes studied were deep. Ella, Manzanita, Turner, and Wilson lakes have mean depths of 70.2, 49.0, 30.3, and 54.1 meters, respectively.

Physical and Chemical Considerations:

Observations of temperature, Secchi disc visibility, pH, conductivity, alkalinity, and hardness were made on each lake during the survey period.

Thermal profiles of Ella, Manzanita, and Wilson lakes are shown in Figures 5 through 7. Pronounced thermal stratification during the summer season varied from 2 to 10 meters, depending upon wind conditions.

Alkalinity, conductivity, hardness, and pH of lakes are summarized in Table 5. A partial listing of water quality and nutrient analyses for all lakes studied during 1977 is presented in Table 6. This listing will be completed when laboratory results are received from the Alaska Department of Environmental Conservation laboratory in Douglas, Alaska.

The morphoedaphic index (Ryder, 1964; 1965) is an empirically derived formula that was described initially as a convenient method of rapidly calculating potential fish yields from unexploited north-temperate lakes. Since its inception, the constraints on the use of the morphoedaphic index (MEI) have been relaxed, as it has been applied to sets of lakes other than those for which it was originally devised. Various investigators have clarified our understanding of the MEI (e.g., Jenkins, 1967; Regier et al., 1971; Henderson et al., 1973) and have extended the application of this index to other climatic systems.

The MEI for five lakes studied this summer are presented in Table 7.

Conductivity of Ella Lake (47 micromhos), Manzanita Lake (60 micromhos), and Wilson Lake (51 micromhos) is the highest of lakes studied so far in southeast Alaska. Because of their deep mean depth the MEI falls near the bottom of the range for southeast Alaska lakes. Turner Lake (15 micromhos) and Virginia Lake (18 micromhos) are among the lowest conductivity. Virginia Lake, because of its shallow depth, reflects a high MEI. Turner Lake has the third lowest MEI of lakes studied to date.

Plankton:

Zooplankton populations were monitored throughout the summer at Ella Lake (Table 8), Manzanita Lake (Table 9), Turner Lake (Table 10), and Wilson Lake (Table 11). A list of zooplankton species identified is presented in Table 12.

Although a standing crop of plankton does not measure production, net plankton samples may show some distinction between oligotrophic and eutrophic lakes. Rawson (1953) stated that the standing crop of No. 20 net plankton measured by total vertical hauls exhibits this distinction

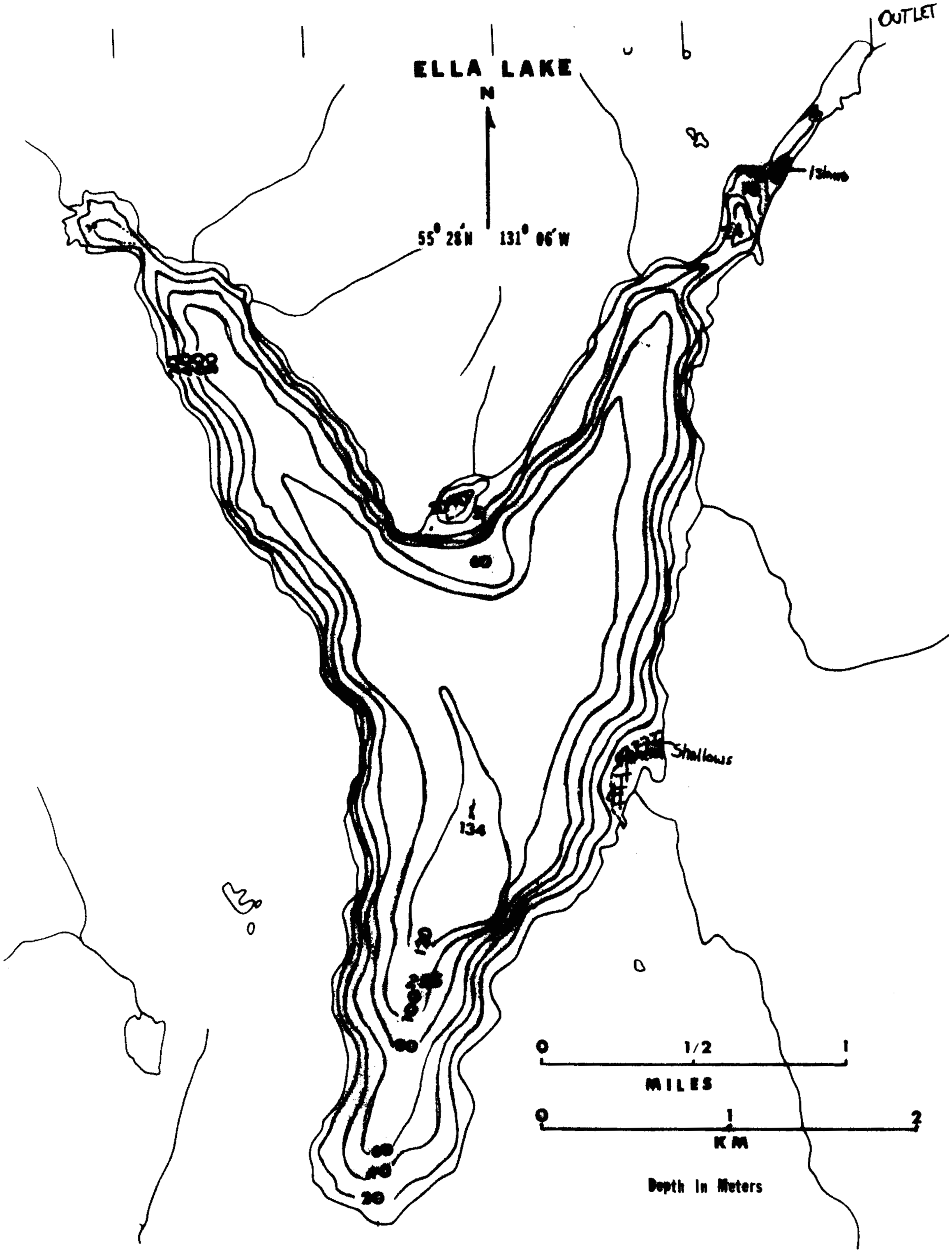


Figure 1. Bathymetric map of Ella Lake.

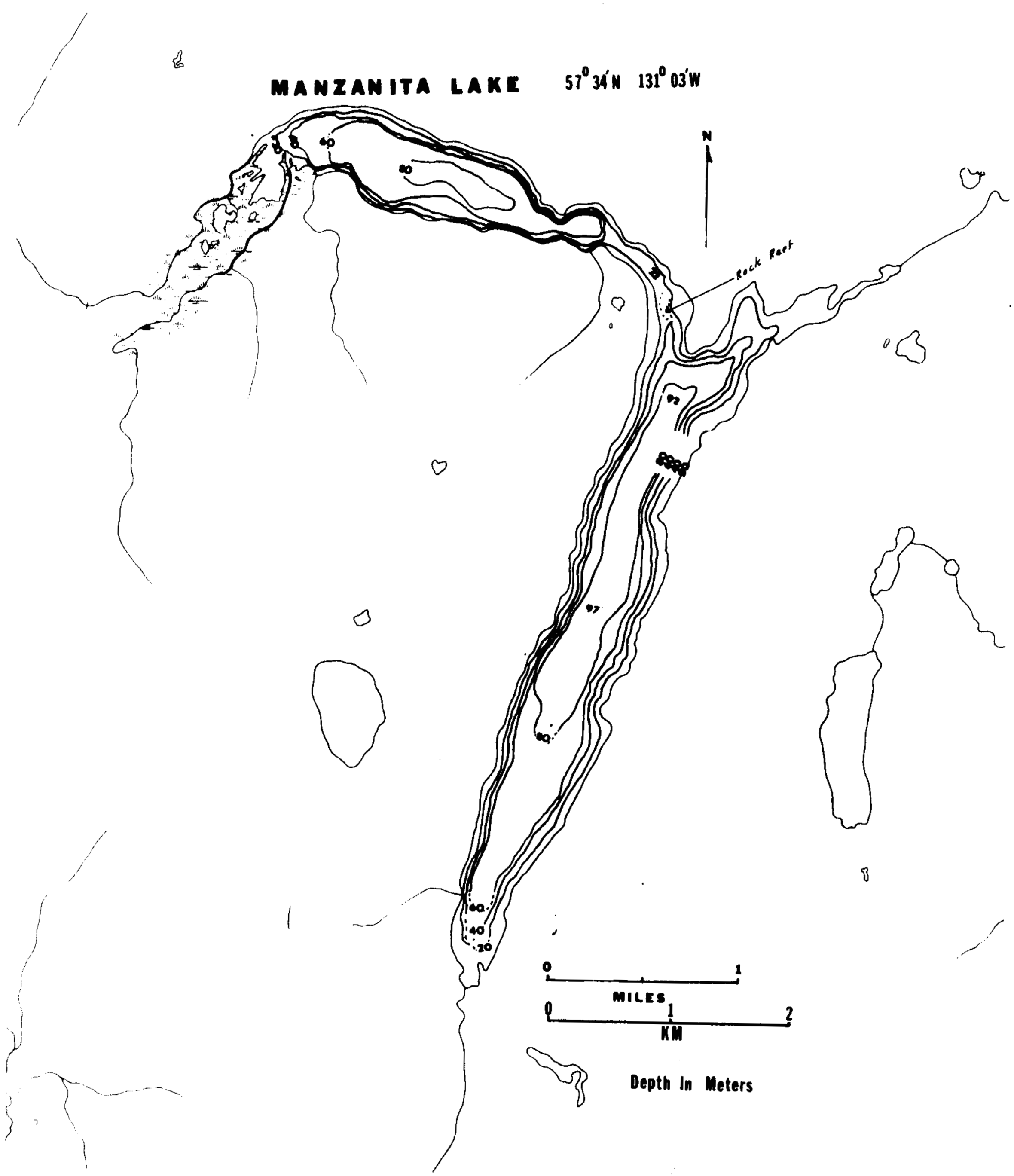


Figure 2. Bathymetric map of Manzanita Lake.

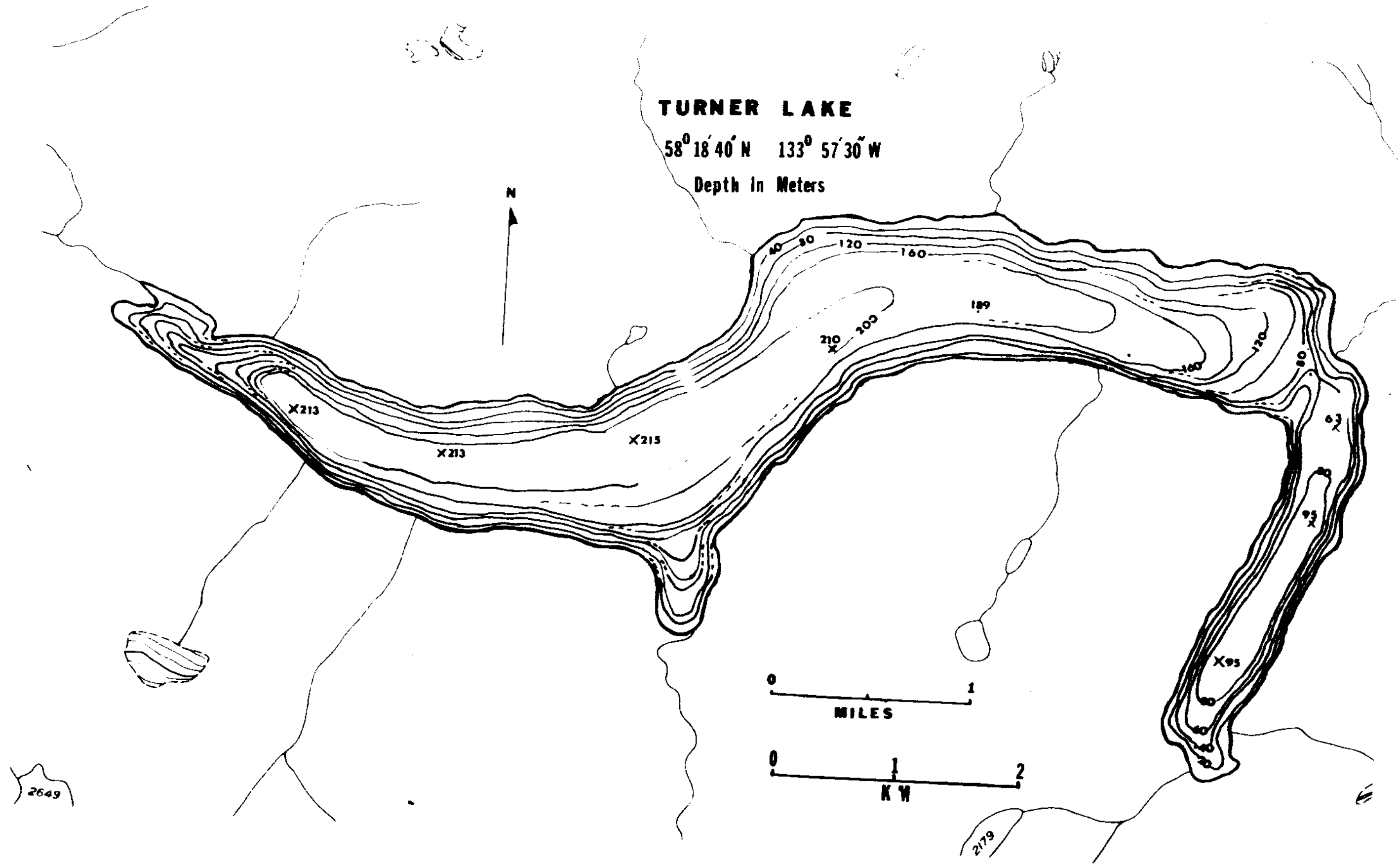


Figure 3. Bathymetric map of Turner Lake.

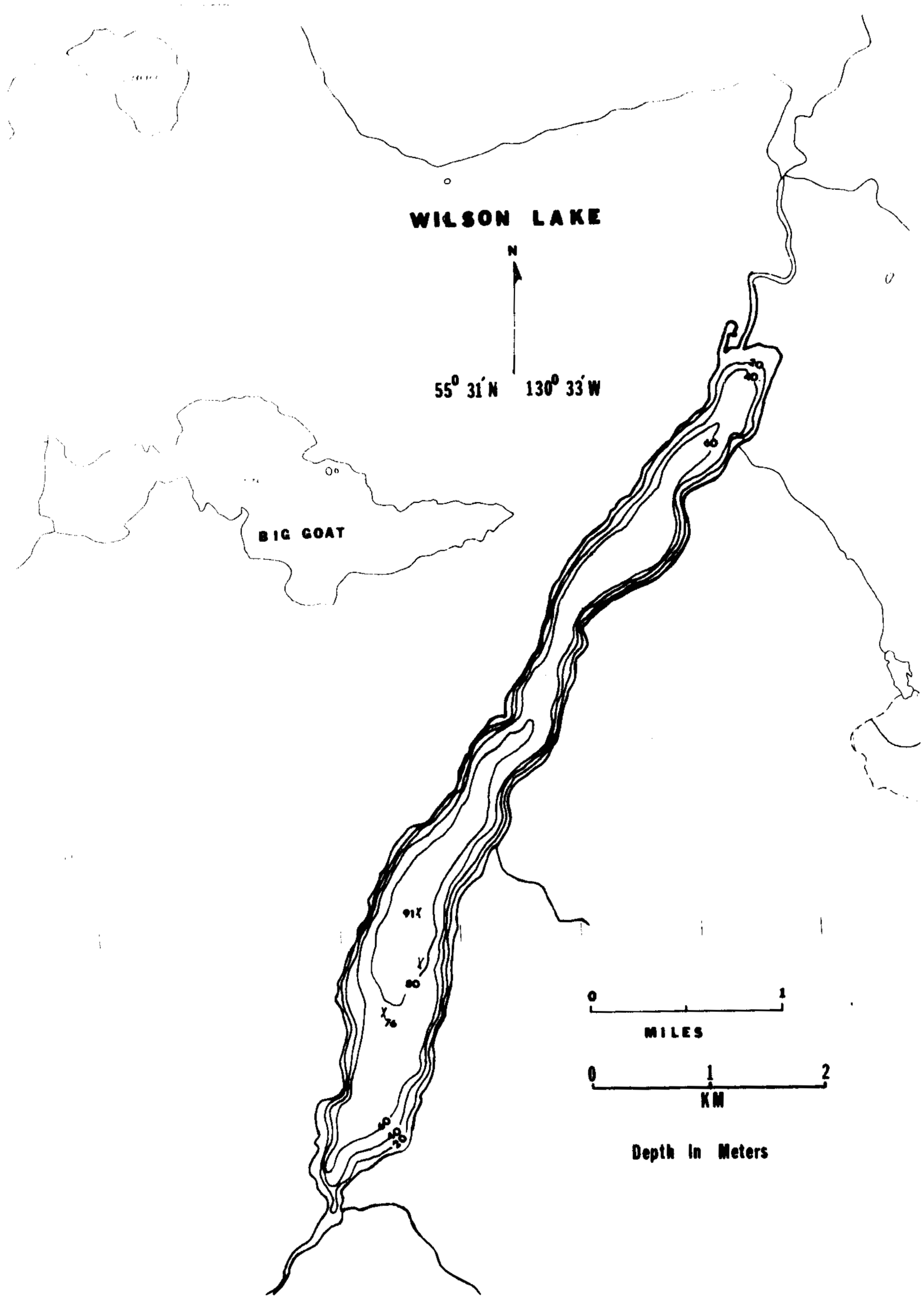


Figure 4. Bathymetric map of Wilson Lake.

Table 1. Morphometry of Ella Lake.

Water Area 709.8 ha or 1,753.2 acres

Area by Depth Zone

Depth Zone (m)	Area (m^2)	Percent of Total Area
0- 20	1,103,558	15.5
20- 40	792,927	11.2
40- 60	743,880	10.5
60- 80	964,592	13.6
80-100	1,316,096	18.5
100-120	1,847,438	26.0
120-134	310,631	4.4
134	16,349	0.2

Water Volume

Cubic Meters 498.6×10^6

Acre Feet 403.9×10^3

Volume by Depth Zone

Depth Zone (m)	Volume (m^3)	Percent of Total Volume
0- 20	130,718,471	26.2
20- 40	111,815,228	22.4
40- 60	96,445,240	19.3
60- 80	79,260,306	15.9
80-100	56,132,659	11.3
100-120	22,297,347	4.5
120-134	1,943,406	0.4

Maximum Depth = 134.0 m

Mean Depth = 70.2 m

Shoreline Length = 19,799.3 m

Shoreline Development = 2.1

Table 2. Morphometry of Manzanita Lake.

Water Area 624.7 ha or 1,543. acres

Area by Depth Zone

Depth Zone (m)	Area (m^2)	Percent of Total Area
0-20	1,077,423	17.1
20-40	1,479,586	23.5
40-60	784,753	12.4
60-80	1,782,042	28.2
80-97	1,126,038	17.8
97	59,265	0.9

Water Volume

Cubic Meters 312.0×10^6

Acre Feet 25.3×10^4

Volume by Depth Zone

Depth Zone (m)	Volume (m^3)	Percent of Total Volume
0-20	109,777,729	35.2
20-40	84,976,596	27.2
40-60	67,041,166	21.5
60-80	40,187,135	12.9
80-97	10,064,069	3.2

Maximum Depth = 97.0 m

Mean Depth = 49.1 m

Shoreline Length = 25,755.2 m

Shoreline Development = 2.9

Table 3. Morphometry of Turner Lake.

Water Area 1,270.2 ha or 3,137.4 acres

Area by Depth Zone

Depth Zone (m)	Area (m^2)	Percent of Total Area
0- 40	3,144,534	24.8
40- 80	1,040,486	8.2
80-120	1,961,539	15.4
120-160	1,561,133	12.3
160-200	2,918,219	23.0
200+	2,076,113	16.3

Water Volume

Cubic Meters 385.1×10^6

Acre Feet 312.0×10^3

Volume by Depth Zone

Depth Zone (m)	Volume (m^3)	Percent of Total Volume
0- 40	110,925,522	28.6
40- 80	90,322,514	23.3
80-120	75,148,706	19.4
120-160	57,572,332	14.9
160-200	34,301,689	8.9
200+	18,861,762	4.9

Maximum Depth = 215.0 m

Mean Depth = 30.3 m

Shoreline Length = 31,068.0 m

Shoreline Development = 2.4

Table 4. Morphometry of Wilson Lake.

Water Area 467.7 ha or 1,155.2 acres

Area by Depth Zone

Depth Zone (m)	Area (m^2)	Percent of Total Area
0-20	694,833	14.9
20-40	588,564	12.6
40-60	907,370	19.4
60-80	1,724,821	36.9
80-91	707,013	15.1
91	53,216	1.1

Water Volume

Cubic Meters 253.2×10^6

Acre Feet 205.1×10^3

Volume by Depth Zone

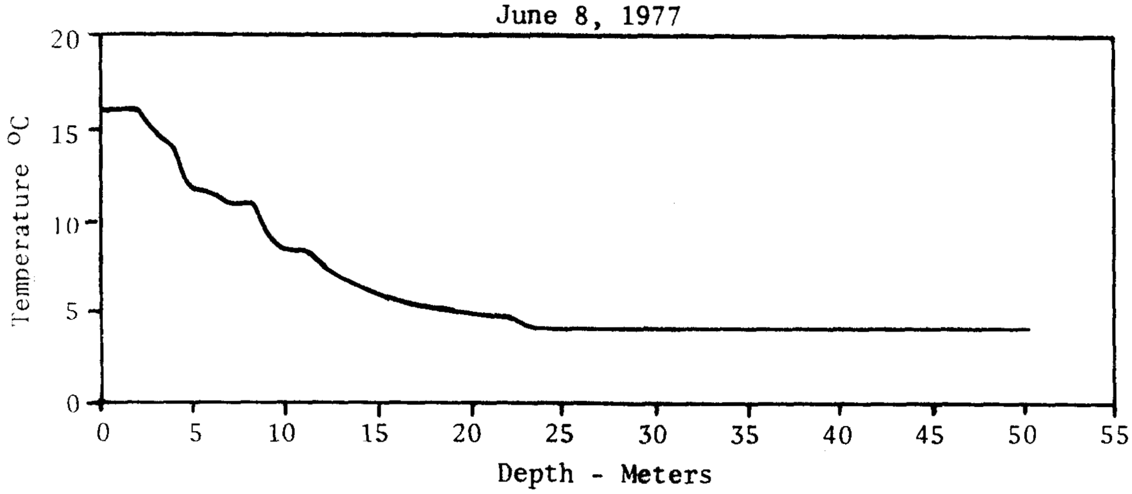
Depth Zone (m)	Volume (m^3)	Percent of Total Volume
0-20	86,474,917	34.1
20-40	73,655,619	29.1
40-60	58,539,822	23.1
60-80	30,798,420	12.2
80-91	3,720,136	1.5

Maximum Depth = 91.0 m

Mean Depth = 54.1 m

Shoreline Length = 19,960.2 m

Shoreline Development = 2.6



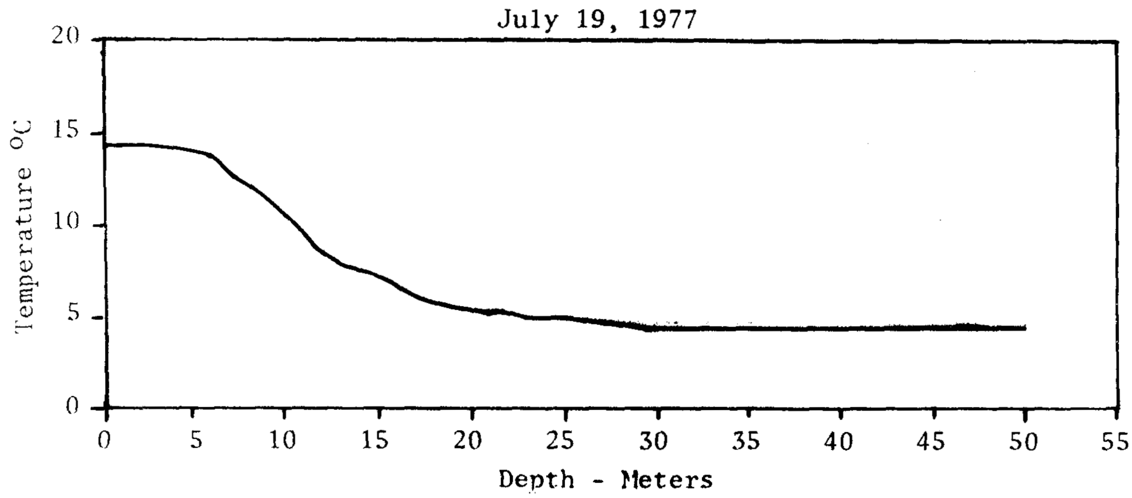


Figure 5. Thermal profile of Ella Lake, 1977.

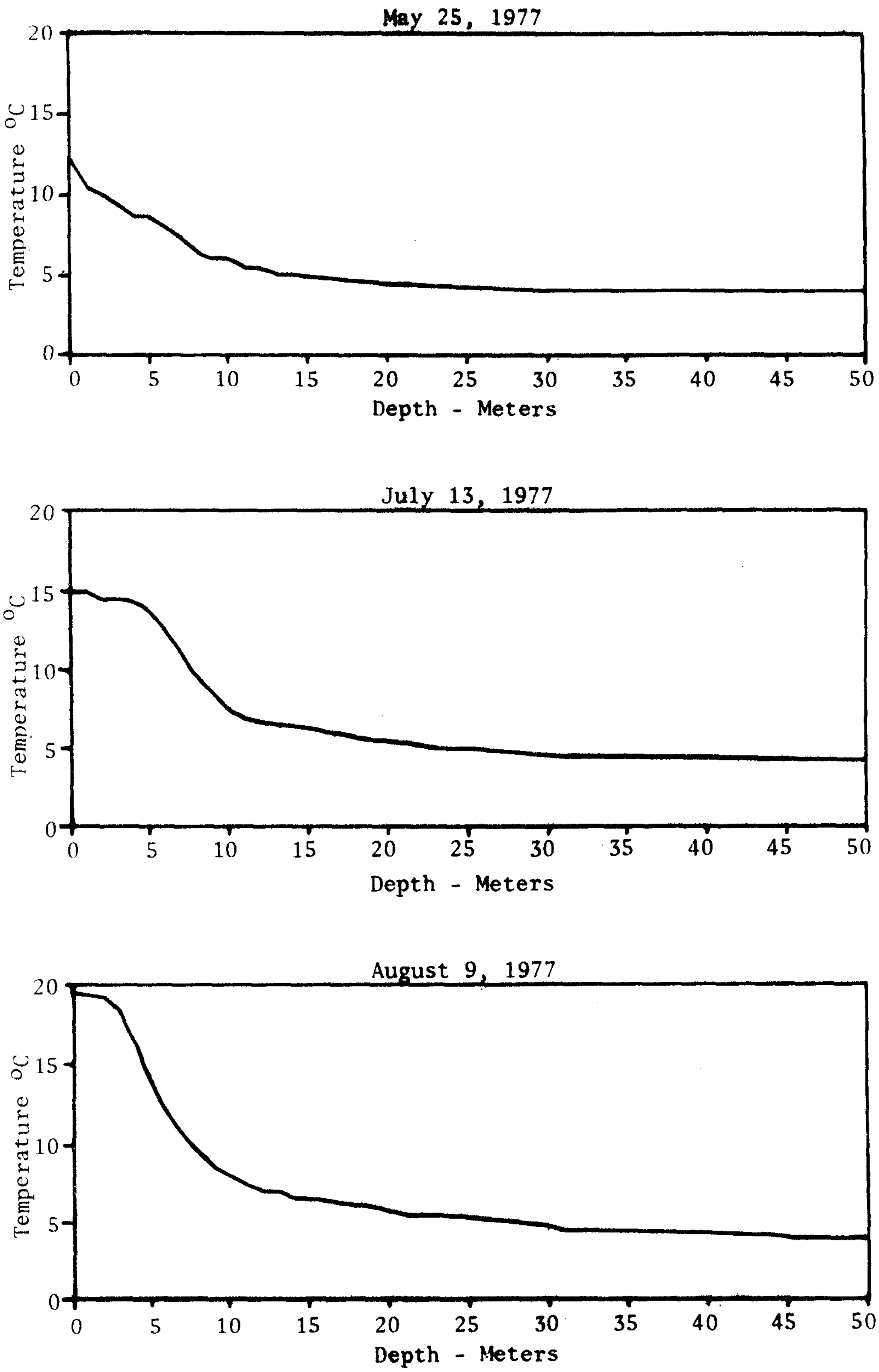


Figure 6. Thermal profile of Manzanita Lake, 1977.

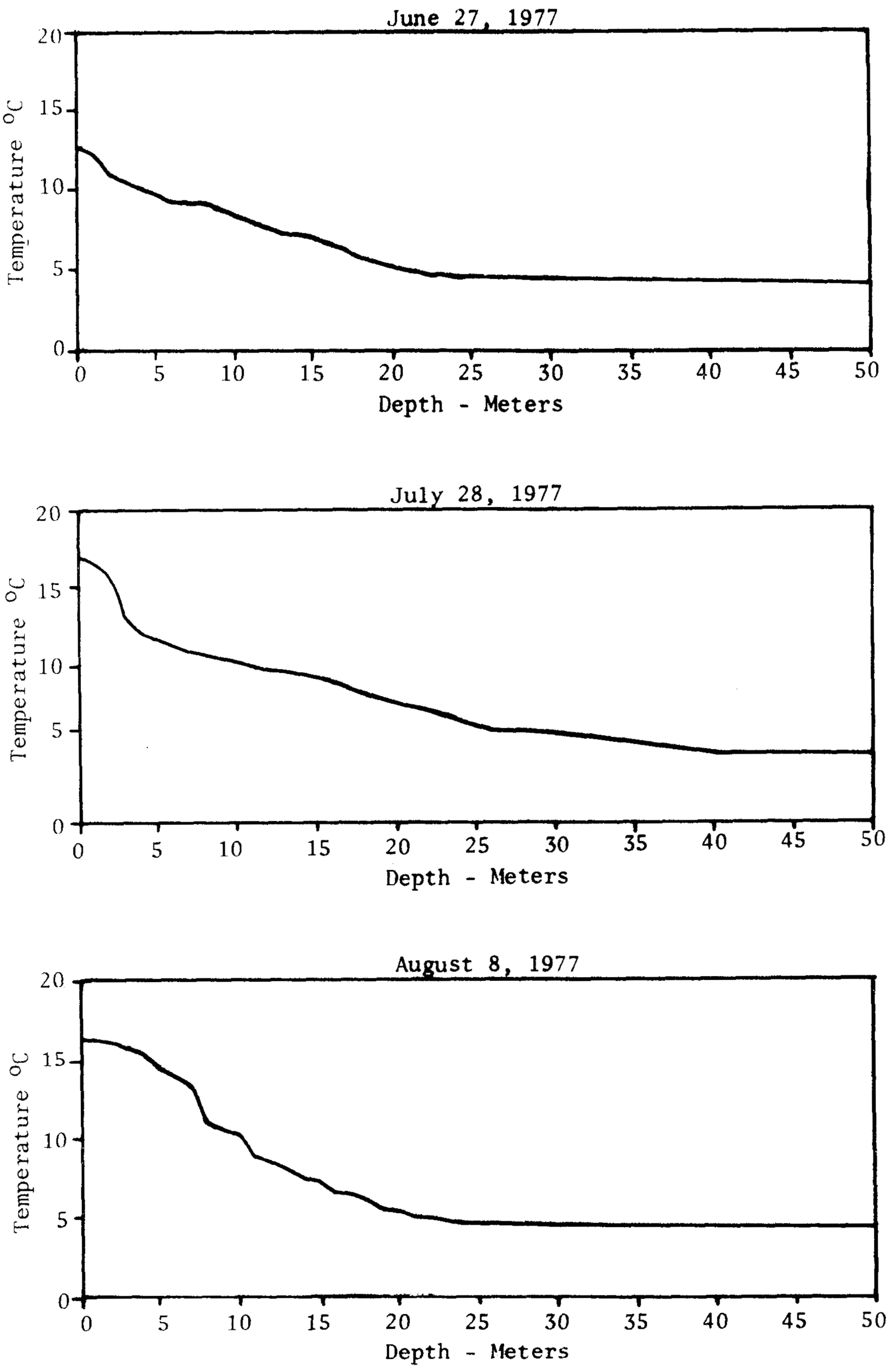


Figure 7. Thermal profile of Wilson Lake, 1977.

Table 5. Alkalinity, conductivity, hardness, pH, and Secchi disc visibility of lakes studied, 1977.

Lake	Alkalinity (mg/l)	Conductivity (micromhos)	Hardness (mg/l)	pH	Secchi Disc (m)
Ella	6.0	47-52	6.0	6.4-6.7	10.0-10.5
Manzanita	5.0	60-68	5.0	6.6	7.0- 9.0
Turner	5.4	12-18	5.0	6.7	ND*
Wilson	3.8	50-55	5.0	5.8-6.5	6.0-11.0

*Not determined.

Table 6. Water quality and nutrient analyses of selected Southeast Alaska lakes, 1977.

Lake and Date	Depth (m)	Alkalinity ($CaCO_3$) (mg/l)	Conductivity (micromhos)	Hardness (mg/l)	pH (units)	Fluoride (mg/l)	Nitrate (mg/l)	Manganese (µg/l)
Ella, October 28	0.3	6.0	47	6.0	6.2	0.035	< 0.20	0.10
Manzanita, October 26	0.3	5.0	60	5.0	6.6	0.054	< 0.20	0.01
Turner, October 3	0.3	5.4	15	5.0	6.7	0.022	0.23	< 0.01
Virginia, October 31	0.3	4.5	18	9.0	6.7	0.042	< 0.20	0.01
Wilson, October 28	0.3	3.8	51	5.0	6.0	0.019	< 0.20	< 0.01

Table 7. Morphoedaphic Index of five lakes in Southeast Alaska.

Lake	Specific Conductance (micromhos)	Residue Dissolved* Calculated Sum (mg/1)	Surface Area (ha)	$\bar{x}$ Depth (m)	MEI**	Potential Yield*** (kg/ha)
Ella	47	33	710	70	0.47	0.66
Manzanita	60	42	625	49	0.86	0.89
Turner	15	10	1,270	30	0.33	0.55
Virginia	18	13	258	13	1.00	0.97
Wilson	51	36	468	54	0.67	0.69

*Calculated as 0.70 x specific conductance in micromhos.

**MEI = Morphoedaphic Index = $\frac{\text{Total Dissolved Solids (TDS)}}{\text{Mean Depth } (\bar{z})}$ (Ryder, 1965)

***Ryder (1965) described the equation $y \sim 2\sqrt{x}$ where y = yield in pounds per acre and mean depth ($\bar{z}$) was in feet. The metric expression (Ryder et al., 1974) is therefore $y \sim 0.066\sqrt{x}$ where yield is fish yield as kg/ha and x = MEI.

Table 8. Plankton composition, density (organisms per square meter), and weight (milligrams per square meter) as collected with No. 153 and 80 Nitex plankton nets, Ella Lake, 1977.

Date	June 8		July 19		August 16		August 30	
Depth of Tow (m)	90	90	100	100	100	100	100	100
Mesh Size	153	80	153	80	153	80	153	80
Copepoda								
Calanoida								
Diaptomus sp.	16,797	16,797	13,997	3,563	763	509	2,036	763
Cyclopoida	207,672	87,802	249,410	97,219	95,437	69,224	125,214	81,694
Nauplii	3,054	7,635	1,272	7,635	763	34,103	4,072	32,830
Cladocera								
Bosmia sp.	31,303	18,324	59,807	11,707	35,121	36,139	61,080	40,465
Daphnia sp.	3,817	763	11,452	13,234	22,905	7,635	9,162	6,108
Holopedium sp.	12,979	14,506	21,632	12,216	7,635	4,581	3,054	3,054
Polyphemus sp.				1,018		1,018	1,018	
Rotatoria								
Kellicottia sp.	1,527	3,054	8,907	11,198	4,581	22,905	24,432	47,337
Keratella sp.								1,527
Miscellaneous						25,959		
Dry Weight	386.8	340.0	406.1	219.3	246.3	213.7	242.2	203.0
Organic Weight	351.7	312.5	320.6	156.2	141.5	130.3	189.3	198.0
Ash Weight	35.1	27.4	85.5	63.1	104.8	83.4	52.9	5.0

Table 9. Plankton composition, density (organisms per square meter), and weight (milligrams per square meter) as collected with No. 153 and 80 Nitex plankton nets, Manzanita Lake, 1977.

Date	May 25		June 16		July 13		August 9		August 30	
Depth of Tow (m)	77	77	12	12	91	91	90	90	90	90
Mesh Size	153	80	153	80	153	80	153	80	153	80
Copepoda										
Calanoida										
Diaptomus sp.	509		9,925	9,162	17,560	6,871	3,817	1,018		
Cyclopoida	105,363	52,936	3,817	2,545	82,458	63,370	131,322	80,422	66,679	123,687
Nauplii	9,671	14,252				6,108		20,360	66,170	
Cladocera										
Bosmia sp.	4,072	5,090	1,527	509	82,458	32,830	102,309	52,936	22,905	29,776
Daphnia sp.	6,617	6,617		2,036	15,270	7,635	15,270	9,162	6,617	6,108
Holopedium sp.	1,018			509		15,270	12,216	9,162	7,126	15,270
Polyphemus sp.					2,290		763	2,036	509	
Scapholeberis sp.										763
Rotatoria										
Kellicottia sp.	16,797	19,342			22,141	43,519	32,067	43,774	42,247	31,303
Keratella sp.	509							509	2,036	
Miscellaneous	24,432								4,581	
Dry Weight	160.3	102.8	562.4	300.8	540.5	321.1	628.6	229.0	336.4	247.3
Organic Weight	131.8	77.3	479.4	216.3	374.6	216.8	468.2	175.6	274.9	207.1
Ash Weight	28.5	25.4	82.9	84.4	165.9	104.3	160.4	53.4	61.6	40.2

Table 10. Plankton composition, density (organisms per square meter), and weight (milligrams per square meter) as collected with No. 153 Nitex plankton nets, Turner Lake, 1977.

Date	May 26	July 13	June 10	June 29	August 12	September 15
Depth of Tow (m)	30	30		30	30	
Mesh Size	153	153	153	153	153	153
Copepoda						
Cyclopoida	253,991	278,677	39,702	384,295	147,864	232,868
Nauplii	2,036	2,545	6,108			
Cladocera						
Bosmia sp.		21,632		1,273	14,252	13,997
Daphnia sp.	8,144	34,357	5,090	16,542	7,126	30,540
Holopedium sp.	509	199,783	4,072	1,782	92,638	1,273
Scapholeberis sp.		1,272				
Rotatoria						
Asplanchna sp.			2,036		12,470	119,615
Conochilus sp.				3,818	19,597	
Kellicottia sp.	509	1,273	6,108	13,997		15,270
Miscellaneous		11,452		10,180	7,126	482,278
Dry Weight	105.8	887.6	365.9	586.3	725.3	469.8
Organic Weight	104.3	797.6	357.8	535.4	661.7	434.6
Ash Weight	1.5	90.0	8.1	50.9	63.6	35.1

Table 11. Plankton composition, density (organisms per square meter), and weight (milligrams per square meter) as collected with No. 153 and 80 Nitex plankton nets, Wilson Lake, 1977.

Date	June 13		June 21		July 25		August 23	
Depth of Tow (m)	84	84	88	88	100	100	90	90
Mesh Size	153	80	153	80	153	80	153	80
Copepoda								
Calanoida								
Diaptomus sp.	48,864	29,180	31,049	16,033	25,959	11,198		2,290
Cyclopoida	20,018	14,928	11,198	6,108	17,306	11,874	15,779	9,925
Nauplii	4,748	11,539	7,635	16,797	12,216	12,216		6,871
Cladocera								
Bosmia sp.	37,666	21,036	17,305	6,362	55,481	21,719	126,232	42,756
Daphnia sp.	22,054	21,719	14,761	10,689	31,558	7,802	23,414	21,378
Holopedium sp.	1,694	1,018	1,018	509	4,072	677	77,877	35,884
Polyphemus sp.	341				2,545	677	3,054	764
Scapholeberis sp.						677	1,018	
Rotatoria								
Kellicottia sp.	3,054	6,785	2,036	2,545	1,527	4,749	2,036	15,270
Keratella sp.		677		2,545		1,018	1,527	9,162
Miscellaneous		56,667	45,810	15,524	5,090	17,647	113,507	128,268
Dry Weight	823.5	435.1	618.4	344.5	892.7	301.3	1,161.0	448.9
Organic Weight	777.2	422.9	541.5	216.8	763.5	275.3	936.5	326.7
Ash Weight	46.3	12.2	76.9	127.7	129.2	26.0	224.4	122.1

Table 12. List of zooplankton species identified by lake, 1977.

Ella Lake:

Chydorus sphaericus (?) (Muller, 1785) - id. from one specimen only
Polyphemus pediculus
Daphnia longiremis
Scapholeberis kingi
Holopedium gibberum
Bosmina longirostris or Eubosmina sp.
Cyclops bicuspidatus thomasi Forbes, 1882 - most common cyclopoid
Cyclops vernalis
Diaptomus kenai

Manzanita Lake:

Polyphemus pediculus
Daphnia longiremis
Scapholeberis kingi
Holopedium gibberum
Bosmina longirostris or Eubosmina sp.
Cyclops bicuspidatus thomasi - most common cyclopoid
Cyclops vernalis
Diaptomus kenai

Turner Lake:

Daphnia longiremis
Scapholeberis kingi
Holopedium gibberum
Bosmina longirostris or Eubosmina sp.
Cyclops scutifer (?) Sars, 1863

Wilson Lake:

Polyphemus pediculus (Linne, 1761)
Daphnia longiremis Sars, 1861
Scapholeberis kingi Sars, 1903
Holopedium gibberum Zaddach, 1855
Bosmina longirostris or Eubosmina sp.
Cyclops vernalis Fisher, 1853
Orthocyclops modestus (Herrick, 1883) - uncommon
Diaptomus kenai Wilson, 1953

in western Canada. He gives this range as 10 to 40 kg/ha dry weight for alpine and large oligotrophic lakes, while mesotrophic and moderately eutrophic lakes have up to 100 kg/ha.

The standing crop of No. 20 net plankton was calculated using an assumed net efficiency of 25%. The organic weight of the four heaviest plankton samples collected throughout the summer was averaged for each lake. Average standing crop (organic weight in kg/ha) of No. 20 net plankton was Ella Lake, 8.0; Turner Lake, 14.1; Manzanita Lake, 8.2; and Wilson Lake, 12.4.

Bottom Fauna:

Bottom fauna collected by dredging and screening benthic material are identified and enumerated in Table 13. Analysis of stream drift organisms from inlet to Ella, Manzanita, Turner, and Wilson lakes (Table 14) shows a wide diversity of species.

Fish:

Lake Inlet and Outlet Areas and Fry Trap Results

Ella Lake: Ella Lake is fed by three major inlets and several small streams. The largest inflow of water measured was during the period July 20 through 25. During this period the east inlet (Figure 8) had discharge of 99 cubic feet per second (cfs), Ella Narrows inlet (Figure 9) had discharge of 43 cfs, and northwest inlet (Figure 10) had discharge of 22 cfs. Other minor inlets contributed from 0.2 cfs to 15.0 cfs (Red Alders inlet) (Figure 11) during this period.

The outlet, Ella Creek, exits Ella Lake at the northeast corner of the lake. There are two forks of Ella Creek (Figure 12) where it leaves the lake. One fork flows northwest and is a slow, meandering stream with much beaver activity. The other fork flows through a large muskeg pond toward lower Ella Lake.

Sixty-three fry traps (Table 15) were placed in inlets and the outlet during the summer with a resultant catch of 149 Dolly Varden, Salvelinus malma (Walbaum); 31 cutthroat trout, Salmo clarki Richardson; numerous threespine stickleback, Gasterosteus aculeatus Linnaeus; and cottids, Cottidae spp.

Manzanita Lake: Manzanita Lake is fed by two major inlets, one entering from the northwest (Figure 13) and one from the south (Figure 14). The northwest inlet contributes the most flow into the lake. Measurements during the study period varied from 29 to 98 cfs. The south inlet is small (1-19 cfs) but has many rearing fish (Table 15).

The outlet stream exits the northeast arm of the lake and flows to Behm Canal. The outlet has an impassable falls just above tidewater which eliminates anadromous fish movement. The beginning of the outlet is plugged by a heavy concentration of logs and debris. This log jam and the boulder

Table 13. Identification and enumeration (organisms/m^2) of benthic organisms from Ella, Manzanita, Turner, and Wilson lakes, 1977.

Lake	Ella	Manzanita	Turner	Wilson
Depth Range (m)	3.0-74.0	2.0-93.0	3.5-29.5	1.0-66.0
Number of Samples	15	8	12	9
Turbellaria	2.9			
Oligochaeta	31.6	43.1	140.0	33.4
Hirudinea		5.4		
Ostracoda	23.0		7.2	
Gastropoda	20.1			
Gyraulus sp.	8.6		50.2	
Pelecypoda	40.2	5.4		
Insecta				
Tricoptera			3.6	
Limnephilidae			10.8	
Diptera				
Chironomidae	28.7	21.5	32.3	81.3
Chironomus chironomus	5.7	64.6	39.5	76.5
Endochironomus sp.			3.6	4.8
Metriocnemus sp.		10.8		
Phaenopsectra sp.	8.6	26.9	807.3	38.3
Polypedilum sp.			3.6	
Procladius sp.		21.5		
Protanypus sp.	2.9	10.8	10.8	4.8
Stenochironomus sp.			3.6	
Stictochironomus sp.				4.8
Tanopodinae sp.	2.9	5.4	10.8	
Tabanidae	2.9			

Table 14. **Identification and enumeration of stream drift organisms from inlets to Ella, Turner, Wilson, and Manzanita lakes, 1977.**

Lake	Ella										Turner					
Date	June 9		July 17		July 20	July 21		August 18		August 19	May 26	July 12	July 13		July 14	
Net	1	2	1	2	1	1	2	1	2	1	1	1 & 2	1	2	1	2
Arachnida																
Hydracarina	1	5		3						3						
Oligochaeta															1	
Collembola				1												
Insecta																
Ephemeroptera																
Siphlonuridae																
Ameletus sp.					1		4							1		
Baetidae																
Baetis bicaudatus						645	638		1		17	22	37	79	105	115
Baetis spp.	1	5		8	101											
Heptageniidae																
Cinygmula sp.					5	4	39	1	2	11						
Epeorus (Iron) albertae					4	31	31									
E. I. deceptivus							6	1		1						
E. I. longimanus					1											
Epeorus sp.										1		1		1		5
Ephemerellidae						1				4				1		
Ephemerella (Drunella) coloradensis					1	7	4									
E. (Drunella) doddsi						1	2			1						
E. heterocaudata																
E. orestes																
Leptophlebiidae																
Paraleptophlebia debilis																
P. memoralis	2	2			5											
Paraleptophlebia sp.				1												
Plecoptera																
Arcynopteryx sp.																1
Acroneuria sp.																
Alloperla sp.							1				13		3			
Isogeninae																
Leuctra augusta		1	1				1									
Zapada sp.						4	12			4	1					
Trichoptera						2									14	22
Limnephilidae	2	2				1	1	2					4		29	19
Rhyacophilidae																
Rhyacophila fuscula						3										
Lepidoptera																
Diptera																
Ceratopogonidae																1
Bibionidae																
Chironomidae																
(Adults and Pupae)		3	2			2										
(Larvae)																
Brillia sp.																
Cardiocladius sp.																
Corynoneura sp.						1										
Cricotopus sp.		1					1			2						
Diamesa sp.																
Heterotrissocladius sp.		1					6	1	6							
Micropsectra sp.							2									
Orthocladius sp.						1	7									
Phaenopsectra sp.																
Polypedilum sp.																
Psectrocladius sp.	1															
Pseudodiamesa c.f. *arctica*						2	1									
Rheorthocladius sp.																
Tanypus sp.																
Tanytarsus sp.	1	1				1										
Unidentified	1	1								2		15	25	3	79	18
Blephariceridae															2	1
Deuterophlibiidae							1							2		
Dixidae																
Empididae		5											1	1		
Rhagionidae					2		4	1					1			
Simuliidae						25	6						3	1	4	
Tipulidae																
Dicranota sp.											1	1	1			1
Coleoptera					2							1			1	1
Amphizoidae						1										
Carabidae							1									
Curculionidae								2		2						
Dytiscidae																
Elateridae		1				1										
Scolytidae																
Staphylinidae	1	2				2	1			1					2	
Collembola											1					
Fish Fry			4					2	1							

Table 14. (Cont.) Identification and enumeration of stream drift organisms from inlets to Ella, Turner, Wilson, and Manzanita lakes, 1977.

Lake	Wilson							Manzanita									
Date	June 23	June 24	July 26	July 27	July 29		August 28	May 24		July 13		July 14		August 10		August 11	
Net	1	2	1	2	1	2	1	1	2	1	2	1	2	1	2	1	2
Arachnida						1			1								
Hydracarina			1	5		2					8	1	2	1	5		
Oligochaeta																	
Collembola				1													
Insecta																	
Ephemeroptera					1												
Siphlonuridae																	
Ameletus sp.	3	2				1		2	4								
Baetidae																	
Baetis bicaudatus	2	17		13	40	24		28	123	1	5	1					
Baetis spp.			7				3					2	3		4		2
Heptageniidae					1												
Cinygmula sp.			4	4				2	14								
Epeorus (Iron) albertae				1	7	1											
E. I. deceptivus																	
E. I. longimanus																	
Epeorus sp.																	
Ephemerellidae																	
Ephemerella (Drunella) coloradensis				1				1		2							
E. (Drunella) doddsi					1	1											
E. heterocaudata			1		2	1											
E. orestes						1											
Leptophlibiidae																	
Paraleptophlebia debilis						1											
P. memoralis												12					
Paraleptophlebia sp.													7				
Plecoptera	3																
Arcynopteryx sp.																	
Acroneuria sp.																	
Alloperla sp.			1					9	27	3	2	1			2		
Isogeninae						1											
Leuctra augusta								1									1
Zapada sp.			4	1		2	1		5	1							
Trichoptera					1	2											
Limnephilidae		1	1					3									
Rhyacophilidae																	
Rhyacophila fuscula																	
Lepidoptera				1													
Diptera																	
Ceratopogonidae																	
Bibionidae															1		
Chironomidae																	
(Adults and Pupae)				1						1		1	1	1	2	2	
(Larvae)																	
Brillia sp.									4								
Cardiocladius sp.			1		2												
Corynoneura sp.																	
Cricotopus sp.				1													1
Diamesa sp.			6					1									
Heterotrissocladius sp.			7		8								3				
Micropsectra sp.								3									
Orthocladius sp.		1				2			1								
Phaenopsectra sp.														3		1	
Polypedilum sp.										1							
Psectrocladius sp.																	
Pseudodiamesa c.f. arctica	1				1	2				2							
Rheorthocladius sp.			7														
Tanypus sp.									1		1	5	1				
Tanytarsus sp.																	
Unidentified				1				1	1		1						
Blephariceridae				1													
Deuterophlibiidae					1	1											
Dixidae						1									1		
Empididae																	
Rhagionidae																	
Simulidae				1								7	4		1		
Tipulidae	2		3	4	3			1									
Dicranota sp.																	
Coleoptera														1			
Amphizoidae																	
Carabidae																	
Curculionidae																	
Dytiscidae				1		1			1	1	1	3	1	1			
Elateridae			1		2												
Scolytidae										1							
Staphylinidae										1					1		
Collembola																	
Fish fry										1							

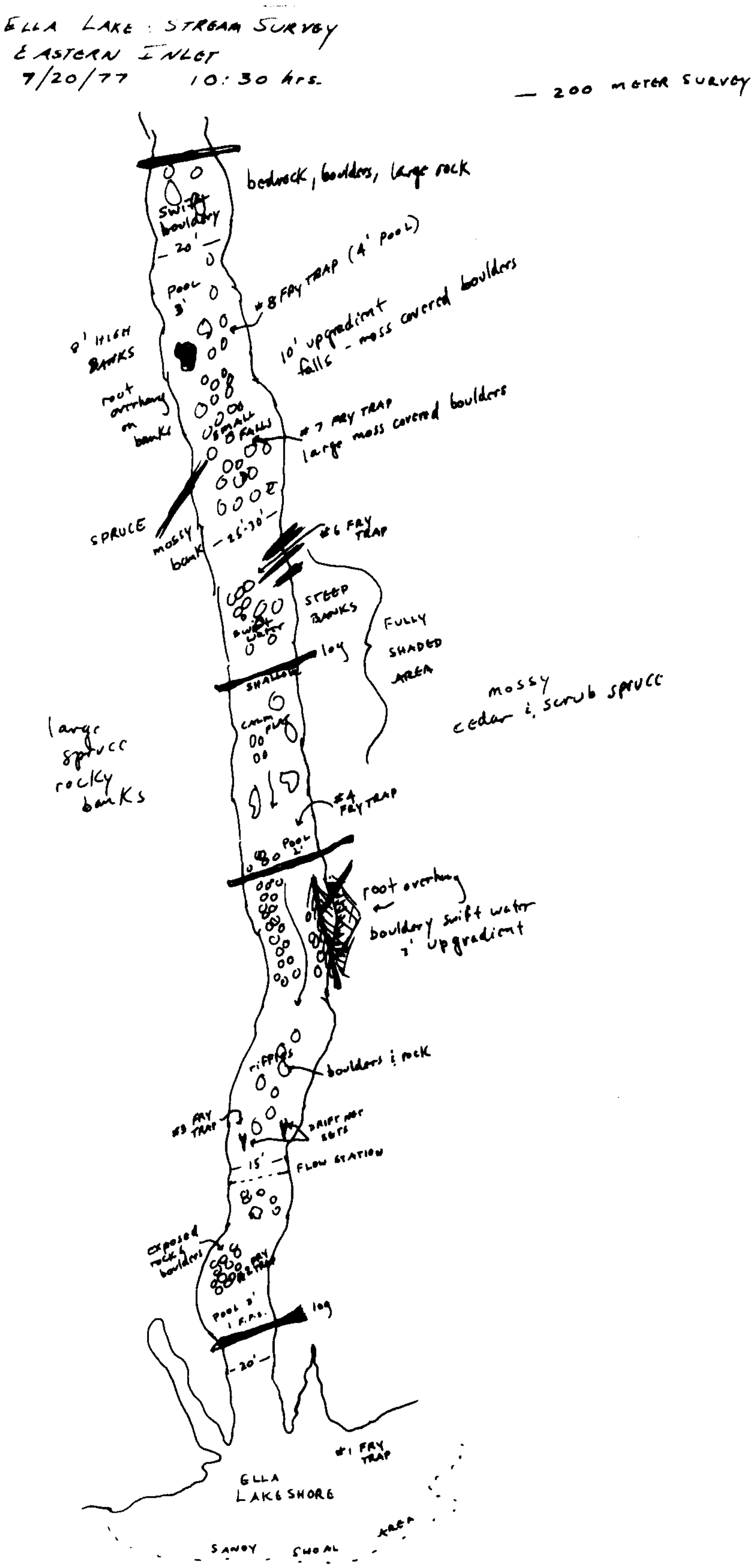


Figure 8. East inlet to Ella Lake.

Figure 9. Ella Narrows inlet to Ella Lake.

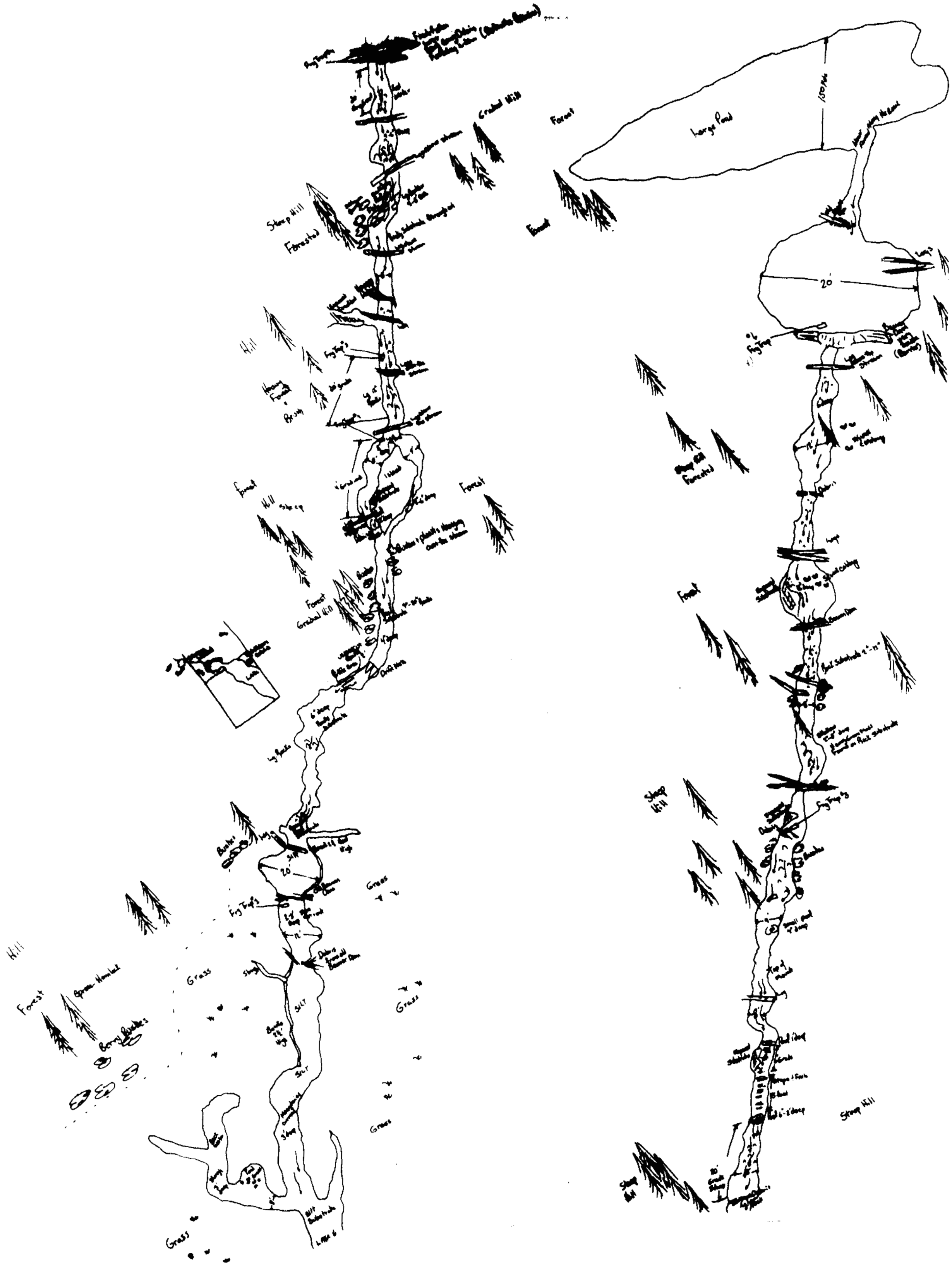


Figure 10. Northwest inlet to Ella Lake.

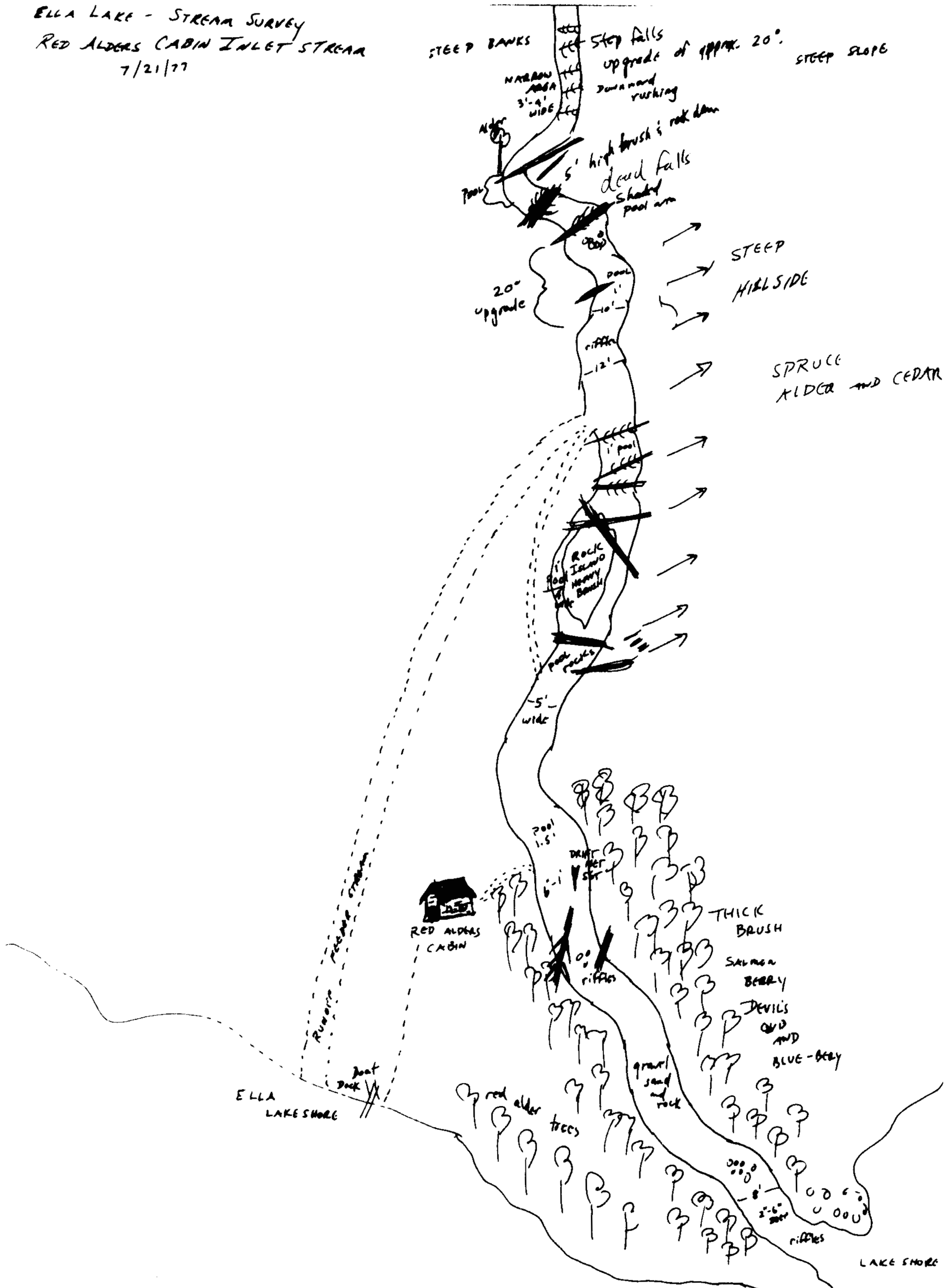


Figure 11. Red Alders inlet to Ella Lake.

ELLA NARROWS OUTLET

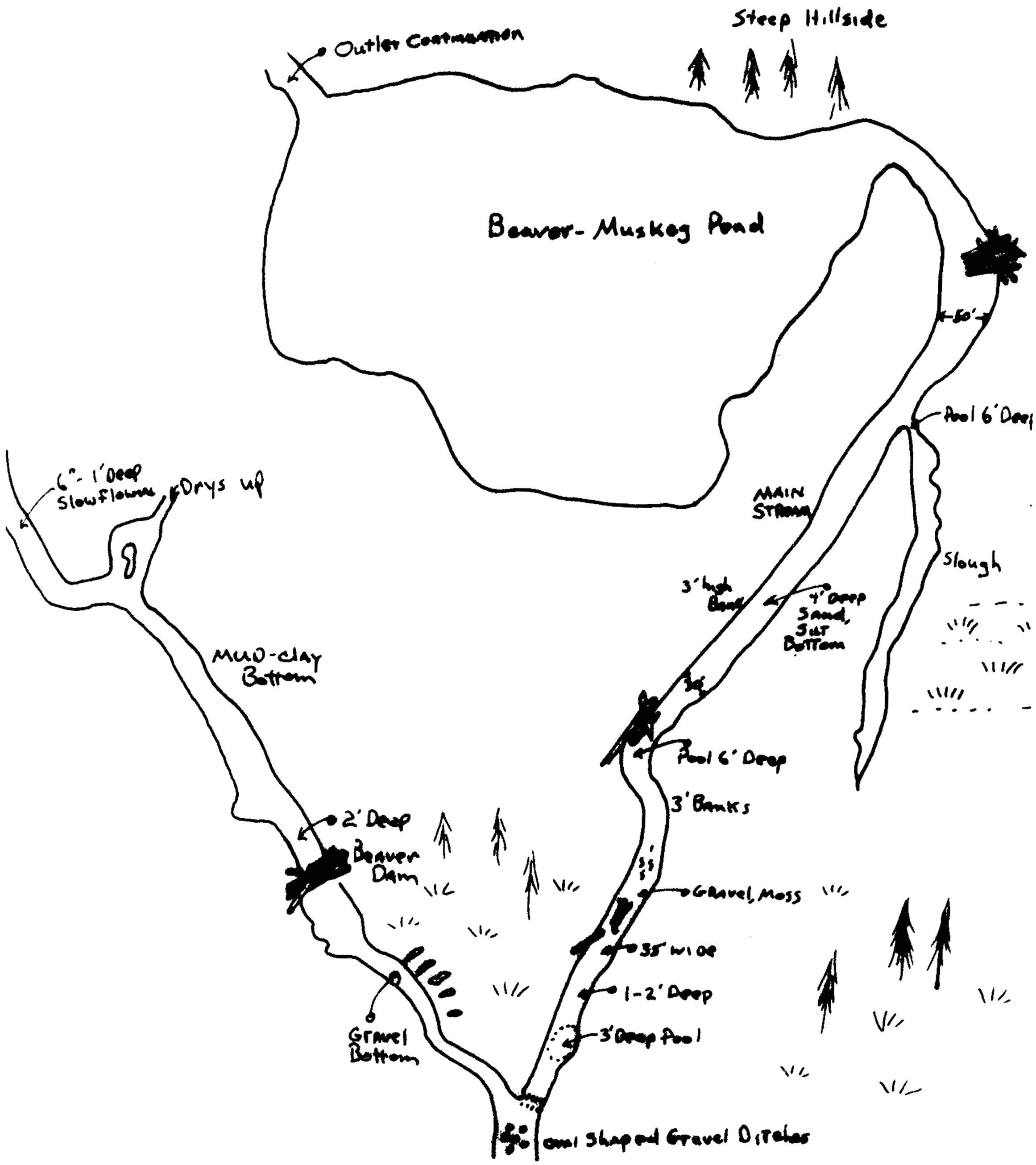


Figure 12. Ella Creek (outlet) from Ella Lake.

Table 15. Summary of fry trap catches by lake and location for lakes studied, 1977.

Lake and Date	Location	Number of Traps	Total Catch
Ella,			
June 10	Red Alders Inlet Cabin	6	34 DV (69-150 mm); 4 CT (89-168 mm); 2 STB; 1 CD
June 10	Ella Narrows Inlet	6	8 DV (55-125 mm); 2 CT (100, 130 mm)
June 20	Northwest Inlet	9	37 DV (75-132 mm); 8 CT (68-117 mm)
	Ella Narrows Inlet	9	28 DV (64-133 mm); 2 CT (71, 91 mm)
	East Inlet	8	1 DV (108 mm)
August 17	West Inlet	4	8 STB; 1 DV (101 mm)
	East Inlet	5	21 DV (58-132 mm)
	Ella Narrows Inlet	5	17 DV (63-138 mm); 12 CT (65-112 mm)
August 18	Northeast Inlet (Minor)	1	2 DV (60, 91 mm); 1 CT (70 mm)
	Outlet (East Fork)	5	86 STB; 4 CD
	Outlet (West Fork)	5	17 STB; 2 CT (72, 73 mm); 1 CD
Manzanita,			
May 26	North Inlet	5	2 DV (73-140 mm)
	South Inlet	6	9 DV (65-145 mm); 4 CT (90-120 mm)
July 13	North Inlet	9	5 DV (72-142 mm)
	South Inlet	8	12 DV (72-120 mm); 6 CT (70-94 mm)
August 10	North Inlet	7	95 DV (63-138 mm)
	South Inlet	7	12 CT (70-122 mm)
	Outlet	2	5 CT (98-160 mm); 3 DV (99-130 mm)
Turner,			
May 25	South Inlet	2	0 Fish
Wilson,			
June 22	Wilson River	8	4 DV (65-135 mm); 1 CT (130 mm)
July 27	Wilson River	9	1 DV (82 mm); 1 CD
	Wilson Narrows (South Inlet)	9	14 DV (68-114 mm); 2 CD
	Southeast Inlet	8	3 CD
	Southwest Inlet	9	2 DV (80, 125 mm)
	Outlet	9	4 DV (78-148 mm); 1 CT (112 mm); 2 CD

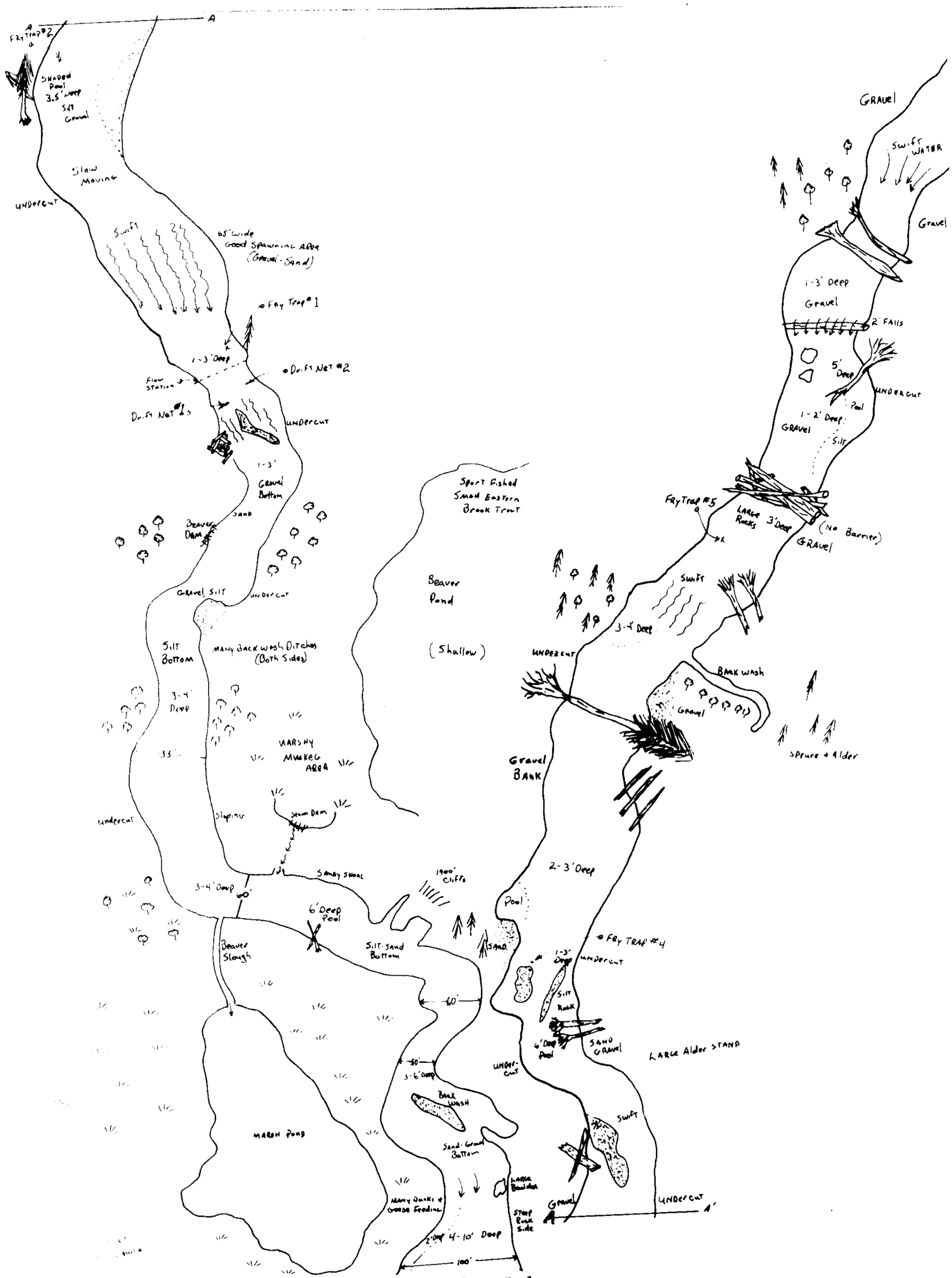


Figure 13. Northwest inlet to Manzanita Lake.

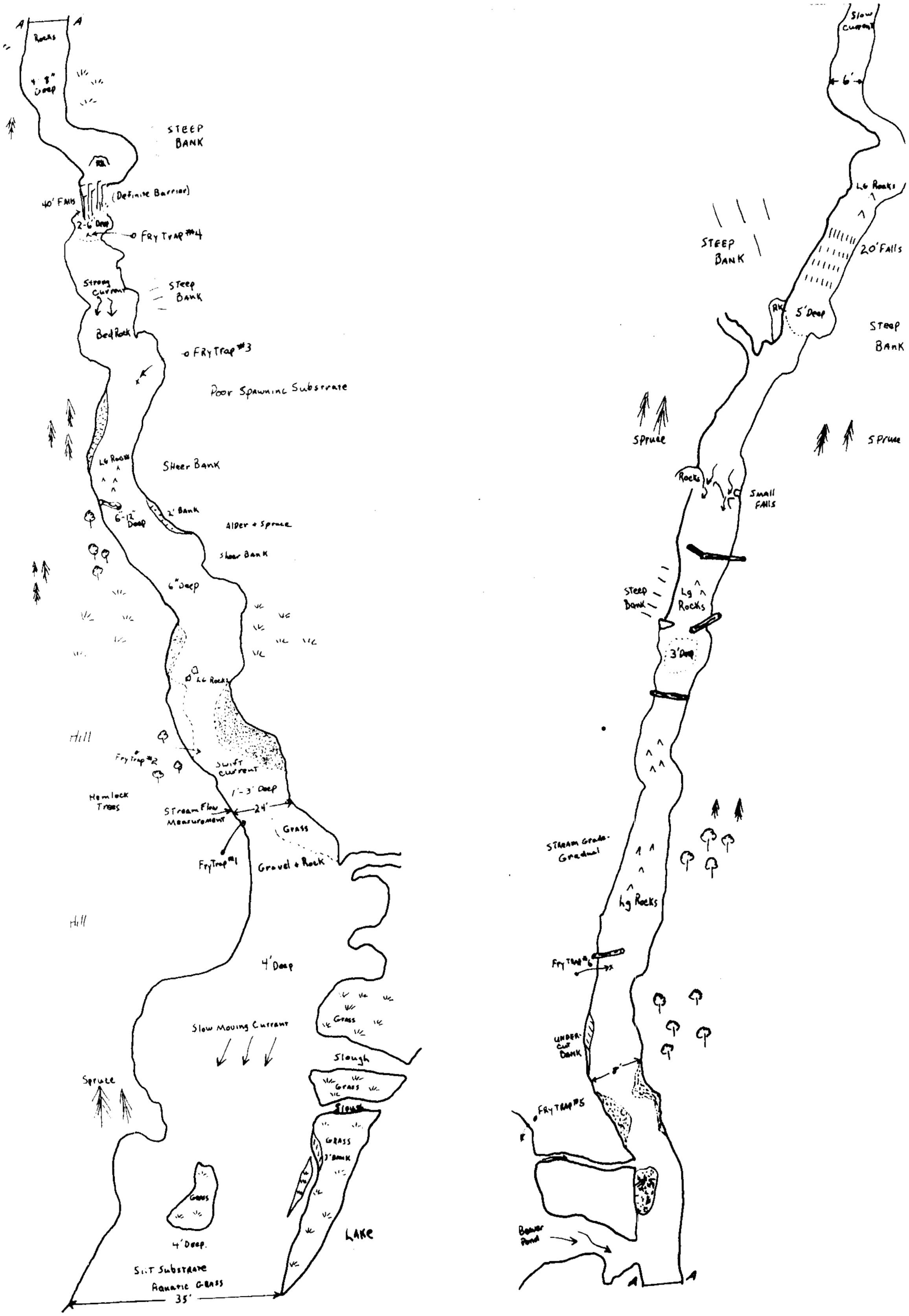


Figure 14. South inlet to Manzanita Lake

chute below it probably limit upstream movement. The outlet is 25 to 30 meters wide with depths up to 2.5 meters and has populations of cutthroat trout and Dolly Varden.

Turner Lake: The main inlet to Turner Lake is located midway on the south side. The stream was surveyed on May 25. No fish were observed or captured in two fry traps during the survey.

The lower 3.2 kilometers (2 miles) of this inlet appear to be good cutthroat trout or sockeye salmon, O. nerka (Walbaum), spawning area. The stream is approximately 12 meters wide in the lower section with water depths of 0.3 to 0.5 meters. Substrate is mainly smaller than 5 centimeters (2 inches) with mostly sand and gravel. This section of stream flows through a broad, flat valley with much alder and sparse willow. The meandering stream has a few root wads and large boulders but very little backwater rearing areas for cutthroat trout. No active beaver dams or fresh cuttings were observed.

The upper 3.2 kilometers (2 miles) of this inlet turns to boulder runs and fast water. This upstream area is probably accessible to fish for another 1.6 to 2.4 kilometers. No trapping or exploration was done in the upper area.

The second important tributary enters the lake near the upper cabin (east Turner). This tributary appears to have excellent spawning and rearing potential. The lower section (50 meters) surveyed had a good combination of rubble and gravel and abundant insect life. This stream appears to be accessible to fish for about 0.8 kilometers.

Wilson Lake: The upper Wilson River (Figure 15) is the major inlet to Wilson Lake. This river is 24.4 to 36.6 meters (80-120 feet) wide and is several kilometers long. It is not known how far fish can go upstream. No barriers were found on the lower 3.2 kilometers (2 miles) which were surveyed. Streamflow varied from 1,225 cfs in late June to 418 cfs in late August. A thorough evaluation of this inlet was not possible because of its size.

Several smaller inlets enter the lake, but none are accessible to fish for more than a few hundred yards. Three of these streams provide a substantial inflow of water to the lake (10-40 cfs), and each is highlighted by a waterfall. With the exception of Wilson River, many of these smaller inlets dried up or provided very little inflow during August.

Wilson Lake is drained by the Wilson River, which flows about 11.3 kilometers (7 miles) to Smeaton Bay. The first mile of the Wilson River below the lake was mapped (Figure 16). A large falls, about 30 meters (100 feet) high, 1.6 kilometer (1 mile) below the lake prevents access to anadromous fish. The portion of the Wilson River below the falls was not examined.

Age, Length-Weight, and Condition Factors

Cutthroat trout from Wilson Lake had the slowest growth rate (Figure 17) but the highest weight at any given length (Figure 18) of all lakes studied. Condition factors of cutthroat trout from Wilson Lake averaged

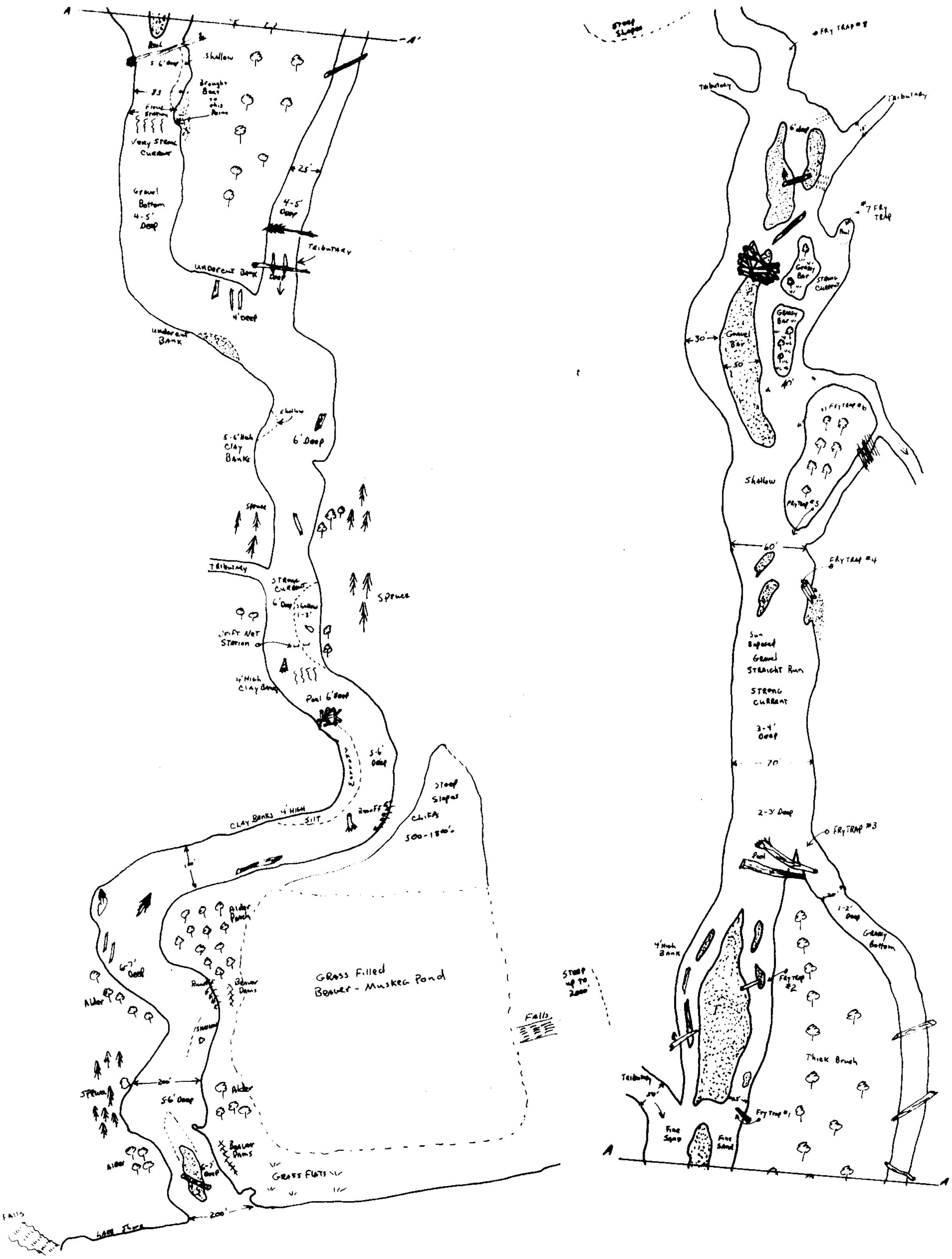


Figure 15. **Upper Wilson River inlet to Wilson Lake.**

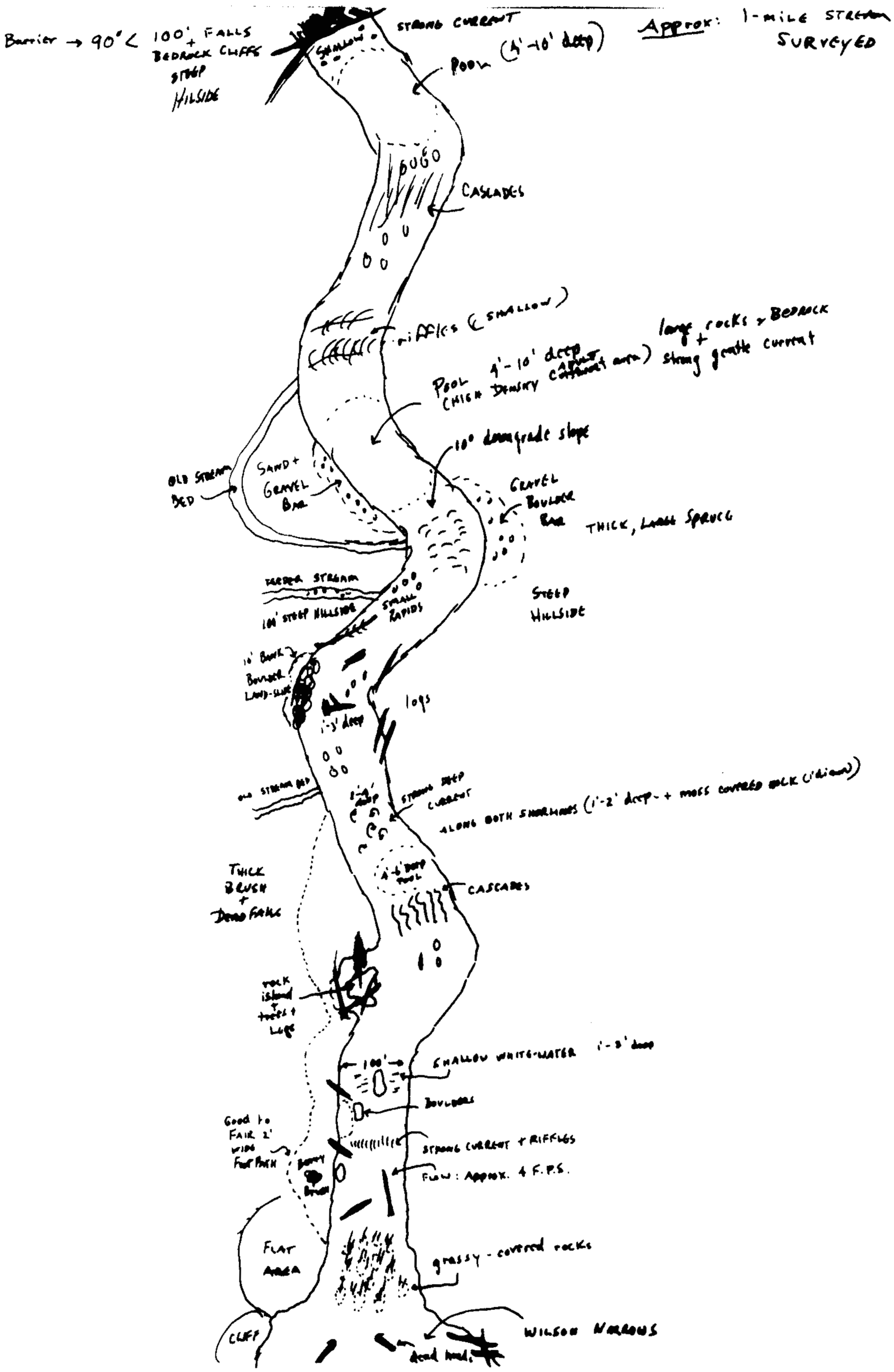


Figure 16. Wilson River outlet from Wilson Lake.

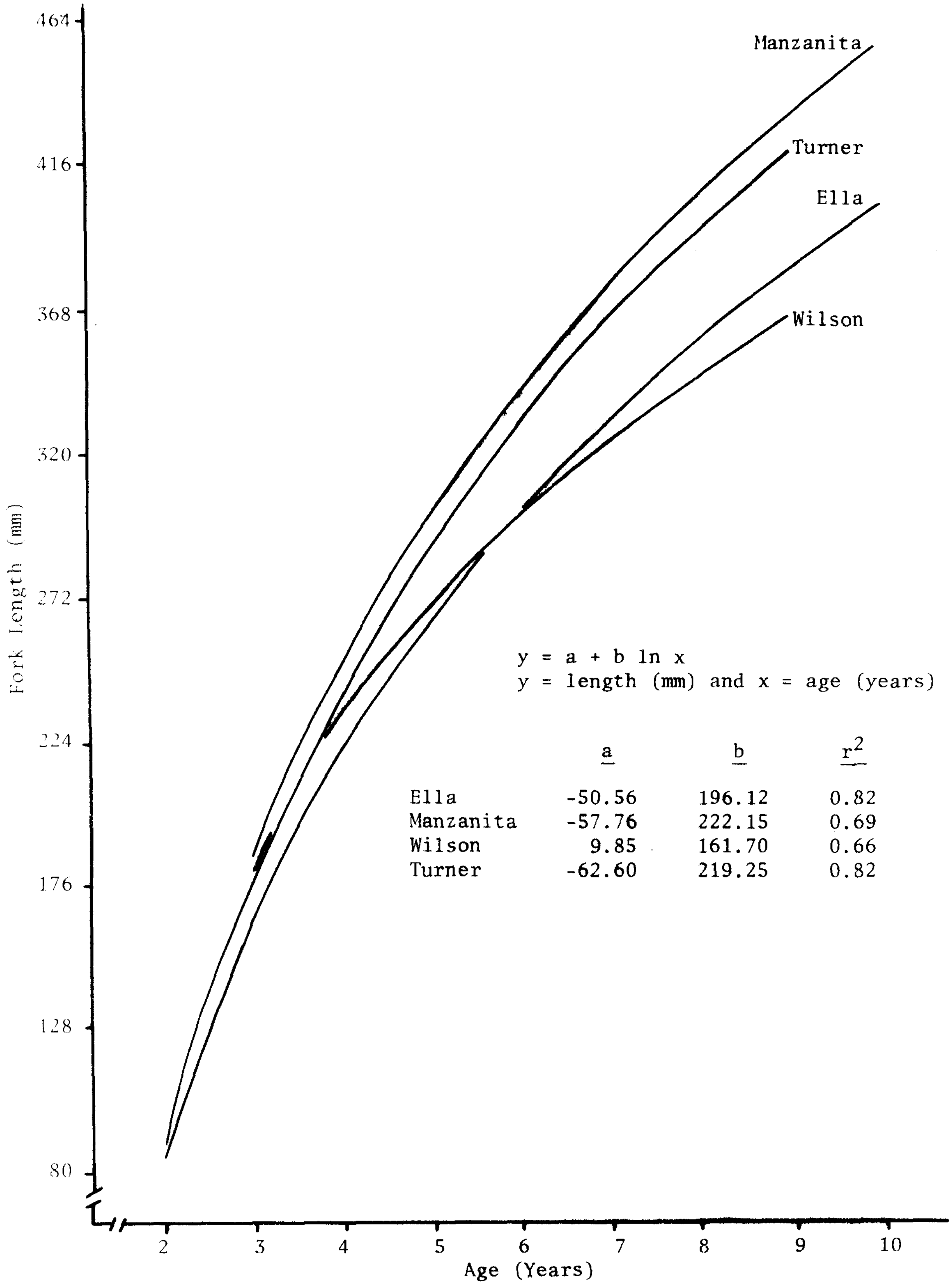


Figure 17. Age and length of cutthroat trout from Ella, Manzanita, Turner, and Wilson lakes, 1977.

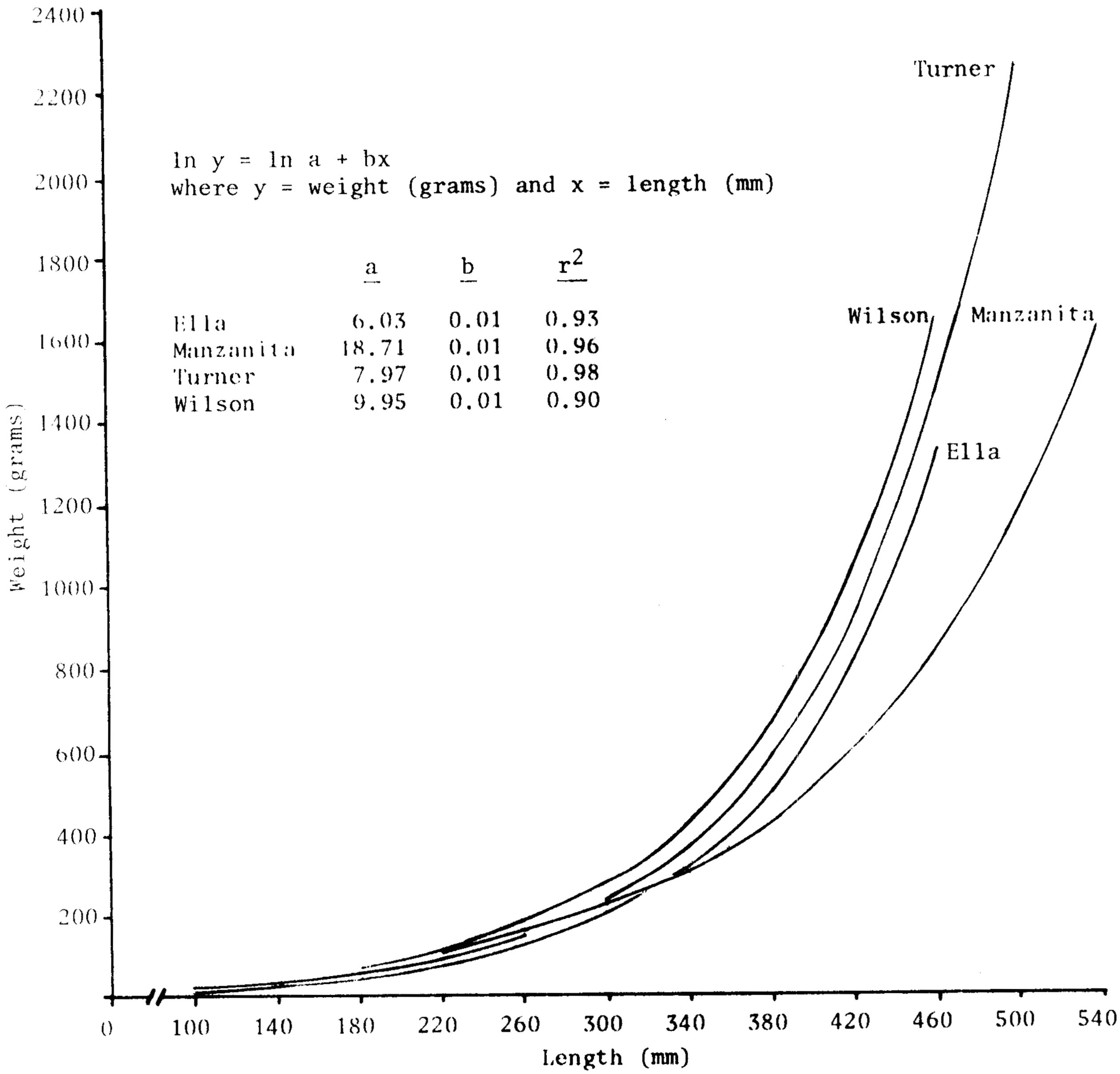


Figure 18. Length and weight of cutthroat trout from Ella, Manzanita, Turner, and Wilson lakes, 1977.

1.05 (Table 16), the highest of all lakes studied. The slow growth and heavy length-weight relationship of these cutthroat trout is just the opposite of what occurred in Manzanita Lake.

Cutthroat trout from Manzanita Lake were longer at any given age but had the lowest weight at any given length. Condition factor of cutthroat trout from Manzanita Lake was 0.88, much lower than Wilson Lake at 1.05. Cutthroat trout from Manzanita Lake appear to have characteristics of both cutthroat and rainbow trout, S. gairdneri Richardson. Samples of these fish should be identified by a taxonomist.

Condition factors of cutthroat trout from Turner Lake were high and very similar to Wilson Lake.

Condition factors of Dolly Varden were lowest in Wilson Lake (0.85) and highest in Ella Lake (1.35) (Table 16). Length at age for Dolly Varden in Manzanita and Turner lakes are presented in Figure 19.

Age-length of kokanee, O. nerka (Walbaum), from Manzanita and Turner lakes are presented in Figure 20.

Food Habits

Stomach contents of cutthroat trout from Ella, Manzanita, Turner, and Wilson lakes were examined and enumerated in Tables 17 through 20. Stomach contents from kokanee are summarized in Table 21. The majority of kokanee fed on insect larvae, pupae, and drift. Only 2 of 34 kokanee examined fed on Cladocera.

Evaluation of High-Quality Fishing Waters

Ella Lake:

Ella Lake (55°28'N, 131°06'W) is located 40 kilometers (25 miles) northeast of Ketchikan on Revillagigedo Island. It is at a surface elevation of 77.7 meters (255 feet) and has a maximum depth of 134 meters. It is a fairly large lake with 764 hectares (1,888 surface acres) of the lake. The lake is relatively deep throughout with steep banks. Some banks are sheer cliffs which drop directly into the lake to depths of up to 42.7 meters (140 feet).

Access to the lake is by floatplane from Ketchikan.

Facilities on the lake consist of two U.S. Forest Service precut panabode cabins; one is located on the northwest arm, eastern shore called the Red Alders Cabin and the other is located on the northeast arm, western shore called the Ella Narrows Cabin. Both cabins are in good shape; each have a wood stove, bunks which can sleep four adults, and a table. There is an inlet at each cabin site which provides fresh drinking water. The cabins don't allow much natural light to enter, so some means of artificial light is recommended.

An aluminum skiff is furnished at each cabin. The Red Alders Cabin skiff is in pretty poor shape; the seats have been destroyed beyond repair, but

Table 16. Condition factors (K)* of cutthroat trout, Dolly Varden, and kokanee, O. nerka (Walbaum), from Ella Manzanita, Turner, and Wilson lakes, 1977.

Lake and Species	Number	Condition Factor (K)* $\bar{x}$	Range	Standard Deviation
Ella,				
Cutthroat Trout	24	0.84	0.45-1.19	0.15
Dolly Varden	3	1.35	0.87-2.31	0.83
Kokanee	11	1.00	0.87-1.35	0.17
Manzanita,				
Cutthroat Trout	27	0.88	0.64-1.28	0.13
Dolly Varden	21	0.95	0.73-1.71	0.20
Turner,				
Cutthroat Trout	25	1.02	0.74-1.32	0.10
Dolly Varden	27	0.94	0.82-1.06	0.07
Kokanee	18	1.03	0.89-1.15	0.08
Wilson				
Cutthroat Trout	50	1.05	0.81-2.09	0.20
Dolly Varden	3	0.85	0.74-1.03	0.16
Kokanee	1	1.03		

$$*K = \frac{100 \text{ x Weight (gm)}}{\text{Fork Lenght (cm)}^3}$$

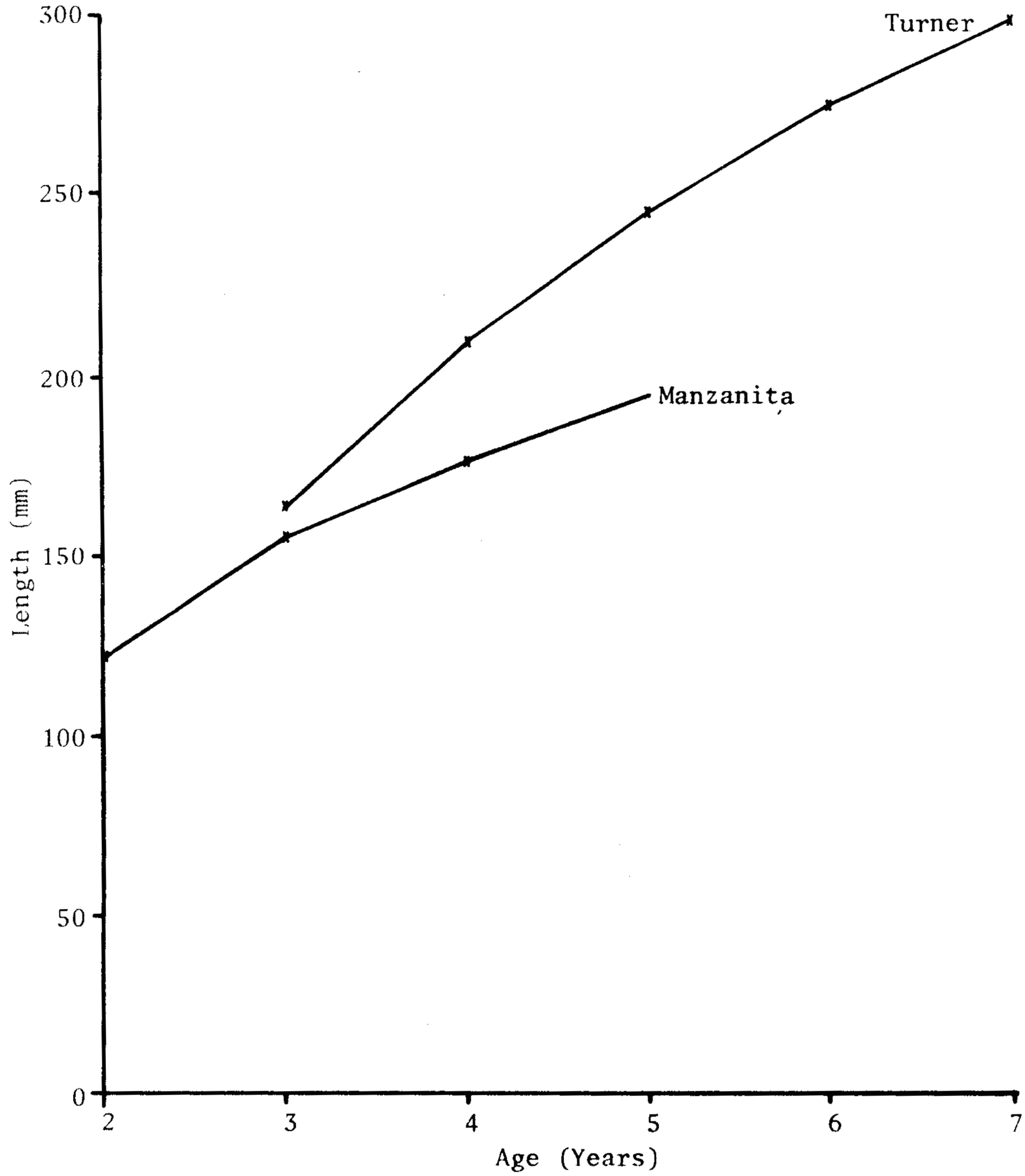


Figure 19. Age and length of Dolly Varden from Manzanita and Turner lakes, 1977.

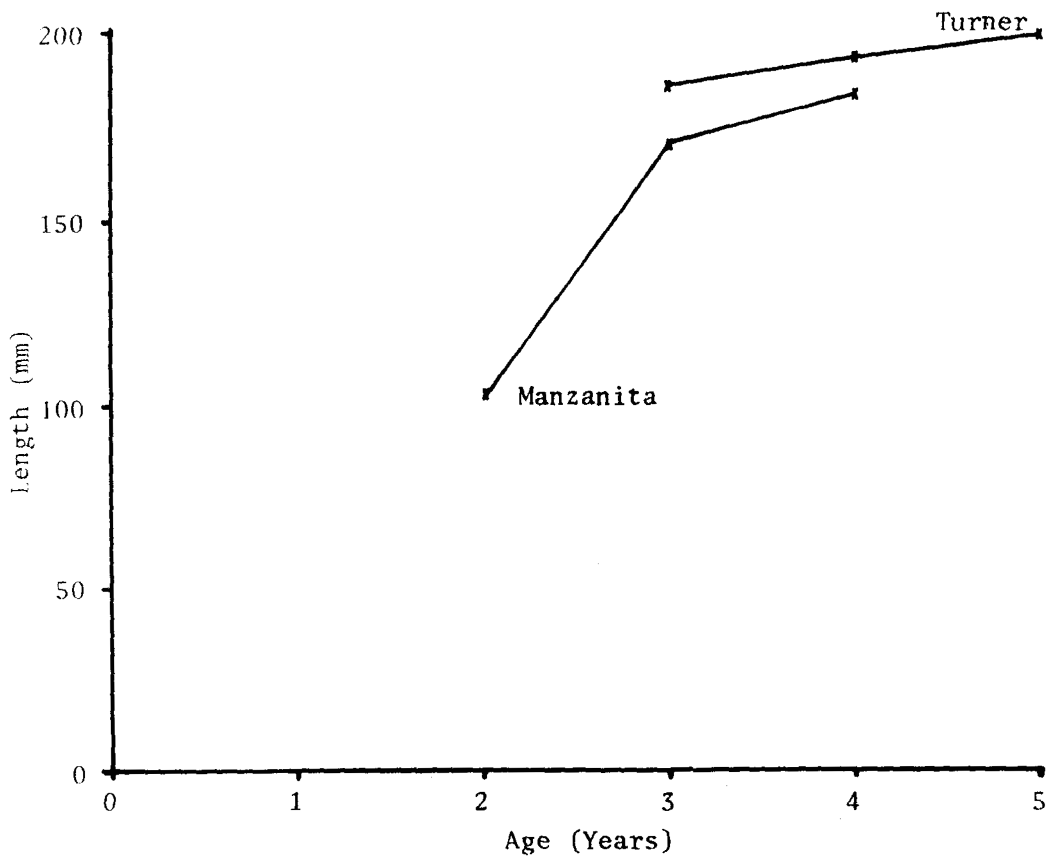


Figure 20. Age and length of kokanee from Manzanita and Turner lakes, 1977.

Table 17. Stomach contents from cutthroat trout, Ella Lake, 1977.

Fish Number	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
Length (mm)	255	117	222	230	281	278	218	130	273	230	298	272	200	263	445	283	424	266	275	240	390
Sex	M	F	F	M	F	F	F	F	F	M	F	F	?	F	M	M	F	M	M	M	F
Hirudinea						1	2														
Insecta																					
Tricoptera																					
Limnephilidae									2												
Leptoceridae		5																			
Diptera															1						
Chironomidae																					
(Adults and Pupae)							2		4			1	23			2					
(Larvae)													9								
Empididae							2		2												
Tipulidae							1					1									
Coleoptera																1	1				
Carabidae												1				1					
Staphylinidae													53								
Hymenoptera													1								
Formicidae									1												
Odonata																	11				
Fish					1		2	1		1	1	3		4		1		1	2	6	2

Table 18. Stomach contents from cutthroat trout, Manzanita Lake, 1977.

Fish Number	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Length (mm)	272	269	275	320	304	262	310	470	354	280	314	445	360	267	324	243	304	247	262	265
Sex	F	M	F	F	F	F	M	F	?	M	M	?	F	M	M	F	F	M	M	M
Hirudinea	14										7									
Insecta																				
Ephemeroptera																				
Baetidae																				
Baetis sp.															1					
Heptageniidae																1				
Plecoptera											2									
Capnia sp.	1										11									
Zapada sp.	1										5									
Tricoptera							2		1											
Limnephilidae				1						2							3			
Diptera																				
Chironomidae																				
(Adults and Pupae)	101			1				1	11		72			104	4	9	62	24	320	21
(Larvae)										1										
Simulidae											2									
Terrestrial						1														
Coleoptera										1					2					
Dytiscidae		117									3					32				
Elateridae										1										
Staphylinidae																			1	
Hymenoptera													5	1						
Fish			1		1		1		1									2		

Table 19. Stomach contents from cutthroat trout, Turner Lake, 1977.

Fish Number	1	2	3	4	5	6	7	8	9	10
Length (mm)	266	290	352	327	270	185	259	174	165	177
Sex	F	M	F	F	M	M	F	M	F	M
Arachnida								1		
Insecta										
Ephemeroptera										
Baetis sp.					1					
Tricoptera		2							1	
Limnephilidae			1			6				
Diptera										
Chironomidae										
(Adults and Pupae)		4		1	2		1	1		
(Larvae)					2					
Empididae				1						
Simulidae		1								
Coleoptera		1						4	2	20
Cantheridae		23								
Carabidae		6								
Cerambycidae				1					1	
Elateridae				1			1	2	4	4
Staphylinidae		4								1
Homoptera										1
Hymenoptera		1		1				3	1	4
Lepidoptera	1									
Fish	3		1		1					

Table 20. Stomach contents from cutthroat trout, Wilson Lake, 1977.

Fish Number	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33
Length (mm)	194	269	240	334	230	306	222	230	237	274	265	314	245	230	275	275	187	295	270	155	257	277	247	235	180	273	295	290	250	210	282	325	380
Sex	F	F	M	F	F	F	M	F	M	M	F	F	F	M	F	F	F	F	F	?	M	F	F	M	M	M	F	F	M	F	F	F	F
Arachnida		1											1						3								1		1	1			
Hydracarina																			1														
Gastropoda																	1																
Insecta																																	
Ephemeroptera												2			5																	1	
Baetis sp.												10			2																	8	
Plecoptera																																	
Alloperla sp.																																1	
Zapada sp.																																3	
Tricoptera (Adults and Pupae)	2		1		1		1	11		1	1	2	1	1				1	1			2			2	4	4	2				2	
Limnephilidae														19		2	10			32										2			
Rhyacophilidae												1																				1	
Diptera																																	
Chironomidae (Adults and Pupae)		8	32		22					3	2	2	17			2			62				2	21	3	31	19	29	12	15	10	39	1
(Larvae)												2																					
Simulidae															1																	5	
Tipulidae																														1		1	
Terrestrial	4	1				2		1					2	1			2	4	7			1	1				2						
Coleoptera	4	2	1		2		2	1	1		1	2	2	3	1	5	10	1	14			1	3	1	2		6	1		1	4		1
Carabidae	1	3	1			1		1			1						2				2	2					1			1	2	1	
Curculionidae																									1								
Dytiscidae																												1			1		
Staphylinidae	1	3											1				1	1												1	1	8	
Tenthridinidae														1																			
Hemiptera	1																1		8												1		
Hymenoptera	1	1					2				1			1	1		1	1	2						2		1	1		1	1	2	
Apidae																					1												
Ichneumonidae														1																			
Lepidoptera													1			1																	
Odonata																		1															
Fish				2							3															2							2
Eggs									3	13	1																	21	2				

Table 21. Stomach contents from kokanee, Ella, Manzanita, Wilson, and Turner lakes, 1977.

Lake	Ella	Manzanita	Wilson	Turner
Number of Fish	11	7	1	15
Arachnida	2			3
Nematoda	1			
Hirudinea		2		
Cladocera		6,000		
Daphnia sp.	6,000			
Ostracoda		5		
Insecta				
Ephemeroptera				
Ameletus sp.			1	
Baetis bicaudatus			53	362
Baetis sp.				5
Cinygmula sp.				1
Epeorus sp.				1
Paraleptophlebia sp.	2			
Plecoptera				
Alloperla sp.				2
Capnia sp.				1
Zapada sp.				7
Trichoptera				
(Adults and Pupae)				50
Limnephilidae				
(Larvae)	5			9
Rhyacophilidae				
(Larvae)				1
Diptera				
Chironomidae				
(Adults and Pupae)	164	49		690
(Larvae)	3	3	1	603
Simulidae				5
Tipulidae	17			14
Empididae		6		
Blephariceridae				4
Deuterophlebiidae				3
Unidentified Diptera	5			8
Coleoptera				3
Cantheridae				1
Cerambycidae				2
Dytiscidae		1		6
Elateridae				6
Scalididae				1
Staphylinidae	31			21
Homoptera				
Aphidae				2
Hymenoptera				15

the boat is functional. The Ella Narrows Cabin skiff is in excellent shape. An outboard is an asset due to the size of the lake.

The cabins were intensively used almost every weekend during June and July. U.S. Forest Service records show the cabins were used 126 days from January 1 to August 1, 1977.

Ella Lake is very scenic, being enclosed by heavily forested mountains. Sitka spruce and hemlock are interspersed with growths of alder in areas of disturbance (landslides, inlet areas, and drainages). The summits of many of the mountains are of bare, granite rock, which contrasts with the trees and adds a touch of awesome beauty. The lake scenery is most easily enjoyed by boat.

Ella Lake has four areas of shallows. One apparent shelf is located on the western shore of the northeast arm and juts approximately 183 meters (200 yards) into the lake. During periods of low water this area must be approached with caution, as depth can be less than 0.6 meter (2 feet). Another shallow area is located near the outlet. This area is also hazardous, for the shallows practically converge, leaving a channel 1.8 meter (6 feet) in width to follow. The area is as shallow as 20 to 25 centimeters (8-10 inches) in many places. Boaters with outboards should pay particular attention to these two areas.

Ella Lake has five species of fish inhabiting the lake: cutthroat trout, kokanee, Dolly Varden, threespine stickleback, and cottids. Cutthroat trout and kokanee are the prime sport fish. The cutthroat trout in Ella Lake have been known to weigh up to 1.4 kilograms (3 pounds) because of the abundant food supply of kokanee, threespine stickleback, and abundant insect larvae drifting in the streams. Fishing at Ella Lake can be erratic at times, but a persistent fisherman is almost guaranteed to catch cutthroat trout, Dolly Varden, or kokanee at any location on the lake. Fishing near the inlet areas proved to be the most productive, especially in the early morning or late evening. Fish were caught using salmon eggs, spinners, large spoons, and flies.

Wildlife encountered included deer (two young, two-point bucks) seen near the Red Alders Cabin. Other mammals were not seen, but the presence of wolf, black bear, and beaver were apparent from fresh spoor. Avian fauna identified consisted of the ever present common loons, common raven, Oregon juncos, song sparrows, Steller's jay, water ouzels, mew gulls, great blue heron, and waterfowl (mallards, goldeneye, and common mergansers).

There is potential for three very good trail sites. At the Ella Narrows area a trail could be made along the inlet stream, which is fairly flat and easily walked. A second trail could be made along the outlet stream and used as easy access to Manzanita Lake. A third trail location could be located at the northwest inlet. This would provide a half hour hike to an upper lake surrounded by alpine scenery.

Manzanita Lake:

Manzanita Lake (55°34'19" N, 131°03'09" W) is located on Revillagigedo Island and drains east into south Behm Canal. It is at a surface elevation of 72.8 meters (239 feet), has a surface area of 624.7 hectares (1,543 acres), and a maximum depth of 97 meters.

Access to the lake is by floatplane, which takes about 20 minutes from Ketchikan.

The facilities on Manzanita Lake consist of two panabode cabins called the Beaver and the Manzanita cabins. The Beaver Cabin is located near the southern end of the lake on the western shore; the Manzanita Cabin is located near the northwest inlet on the southern shore. Each cabin is in good shape with a wood stove, four bunks, and a table, and has an aluminum skiff. The cabins are located adjacent to streams, so fresh water is readily available.

This lake is considered a high-use recreational area. Cabin use from January 1, 1977, to August 1, 1977, was 94 days. Most popular use months are June and July, but cabins are being reserved from April through October.

Manzanita Lake is a large, deep lake approximately 10 kilometers (6 miles) in length and made up of three arms--the northwest arm, the northeast arm, and the southern arm which is the main body of the lake. There is one area of shallows that can be seen at times of low water. It is located 22.9 meters (25 yards) off the northeast shore of the northwest arm. Its exact location should be found on a map before frequenting that portion of the lake, as it is potentially hazardous to boaters and floatplanes.

Manzanita Lake is surrounded by mountains except near the northwest inlet. The northwest inlet is an interesting area. The lower area of the delta is an ecosystem of grassflats, backwater sloughs, and ponds. The inlet stream from its mouth 0.8 kilometers (0.5 mile) upstream is slow and meandering with high clay banks (1.5-2 meters) and a clay-silt substrate. From 0.8 kilometers upstream it is a clear, fast flowing stream moving over a gravel rock substrate.

The south arm inlet drains into a muskeg slough before draining into the main body of water. This inlet is easily accessible from Beaver Cabin by way of the U.S. Forest Service skiff or by walking. From this particular inlet a hardy fisherman, hunter, trapper, or hiker could make his way to Ella Lake in about 2 hours of steady walking.

The lake outlet empties from the northwest arm. The outlet contains impassable falls and a flow too turbulent for anadromous fish species. There was a trail along the outlet to Manzanita Bay. The trail is grown over now but could be improved to provide access for hikers and fishermen.

Manzanita Lake has a healthy population of fish consisting of cutthroat trout; brook trout, S. fontinalis (Mitchell); kokanee; Dolly Varden; threespine stickleback; and sculpin.

Fishing at Manzanita Lake has historically been fantastic for cutthroat trout. It is one of the most popular fishing locations for Ketchikan residents on weekend excursions. Many nonresidents use the cabins for a week at a time, specifically for sport fishing. The lake is well known for large and numerous cutthroat trout. There is a resident population of Dolly Varden, but they are not as abundant nor sought after by the angler. In the 1950's brook trout were introduced in the lake, and anglers are still catching a few at the Beaver Cabin site. Concentrations of fish were found at the two major inlets and the Beaver Cabin area. The outlet stream holds a very healthy population of cutthroat trout and Dolly Varden.

Much of the wildlife was observed near or in the northwest inlet. Waterfowl seen throughout the summer included mallards, pintails, green-winged teal, goldeneye, bufflehead, great blue heron, and a flock of Canadian honkers. Other wildlife known to be in the area were mink, marten, beaver, wolf, and black bears. Mew gulls, common and red-throated loons, and common mergansers were seen throughout the lake. Other avian fauna identified were bald eagles, common ravens, Oregon juncos, water ouzels, wrens, and song sparrows.

Manzanita Lake is an ideal location to take part in the Southeastern experience of natural beauty, fishing excitement, and observation of abundant wildlife.

One recreational enhancement beneficial to the area would be a trail from the southern inlet to Ella Lake.

Turner Lake:

Turner Lake (58°17'N., 133°48'W.) is located 25.7 kilometers (16 miles) east of Juneau at the edge of Taku Inlet. It is at a surface elevation of 22.3 meters (73 feet) and has a maximum depth of 215 meters. Turner Lake is a large lake of about 1,271 hectares (3,140 acres) and is approximately 14 kilometers (9 miles) long. The lake is steep sided except near stream inlets which form limited delta areas.

Access to the lake is by floatplane from Juneau or by a 1.3 kilometer (0.8 mile) trail from Taku Inlet.

The skiffs and facilities at both cabins are good. The West Turner Cabin at the outlet has a massive rock fireplace and is more roomy and comfortable. This cabin has easy access to the outlet area for pink salmon, O. gorbuscha (Walbaum), and Dolly Varden fishing. Black bear frequent this area during the fall.

The East Turner Cabin is smaller but offers complete solitude. The most spectacular scenery is near the east end of Turner Lake.

Turner Lake is in an awesome setting with rugged mountains, glaciers, and numerous waterfalls. Turner Lake is one of the most popular, if not the most popular, lake in the Juneau area with excellent cutthroat trout fishing. Cutthroat trout in the 1.8 to 2.3 kilogram (4-5 pound) class are frequently caught, according to entries in the cabin logbooks.

Other fish species include Dolly Varden, kokanee, and cottids. Dolly Varden were captured on the lake bottom with fish traps, but none were caught with hook and line. Kokanee in the lake reach a length of about 200 millimeters at maturity (age 3-5). The angler fishing for kokanee should use flies or single eggs near the inlets and waterfalls.

The inlet near the East Turner Cabin offers a variety of recreational activities. Birds were abundant and very active during the late May period. The following list includes the birds seen during the period May 25 through 27, 1977.

Hermit thrush	Robin
Dipper	Mallard
Winter wren	Vaux swift
Tree swallow	Barn swallow
Fox sparrow	Spotted sandpiper
Orange-crowned warbler	Wilson's warbler
Varied thrush	Steller's jay
Raven	Bald eagle
Common loon	Ruby-crowned kinglet
Pine siskin	Blue grouse
Mew gull	Rufous hummingbird

Audubons warbler - recorded with tape recorder; good look at individual
Harlequin duck - pair on main inlet

Wilson Lake:

Wilson Lake (55°30'38" N, 130°33'49" W) is a large lake 67.6 kilometers (42 miles) from Ketchikan. The lake has a surface area of 467.7 hectares (1,155 acres) and a maximum depth of 91 meters. Access to the lake is via floatplane from Ketchikan.

Facilities on the lake include two U.S. Forest Service cabins. One is located at the south end near the outlet, Wilson Narrows Cabin; the other, near the upper end of the lake, Wilson View Cabin. Each has an aluminum skiff. The panabode cabins have wood burning stoves, bunks for four adults, axes, and saws. There is an outhouse for each cabin but no form of garbage disposal. Noncombustible items must be packed out of the lake with the visitor. The Wilson Narrows Cabin is in excellent condition due to its recent construction. The Wilson View Cabin is getting rundown and has a few leaks in the roof. Its location, however, makes for easier accessibility to the majority of the lake. Plans are to replace the cabin in the near future.

Many people frequent Wilson Lake throughout the spring, summer, and fall months. The U.S. Forest Service has had more than 100 visitors to their cabins from April through August and expect people to frequent the lake as late as November, depending on weather conditions.

Wilson Lake is an area of scenic beauty. The lake is set between two large mountains whose sides in many areas drop directly into the lake as sheer cliffs. The area is heavily forested with Sitka spruce and hemlock, providing a lush evergreen wilderness setting offset by mountain alpine areas with granitic rock and waterfalls.

The lake is fed by one major inlet at the north end, the upper Wilson River. This river provides the largest inflow of water to the lake. During June, a period of heavy rains and runoff, streamflow reached 1,225 cfs. With such an influx of waters the lake can rise 0.9 to 1.2 meters (3-4 feet) after 2 to 3 days of heavy rains. Many small inlet streams provide 10 to 40 cfs, and each is highlighted by a waterfall. During August many of these smaller inlets dry up, and all except the upper Wilson River inlet were providing very little inflow.

The lake is drained by one outlet, the Wilson River, which is at the south end. It is 50 to 75 meters wide and flows into Smeaton Bay. A large falls, approximately 3,015 meters (100 feet) high, prevents anadromous fish from entering the lake.

Wilson Lake is well known because of its large cutthroat trout. They are the largest and most dominant fish in the lake. Kokanee were evident in stomach samples of cutthroat trout. Dolly Varden were found in the upper Wilson River, but none were caught in the lake. Threespine stickleback were observed in many areas of the lake and found to be a food source for cutthroat trout.

The most productive angler technique for the larger fish is trolling the perimeter of the lake using a lure resembling a kokanee or other small fish. Fishing near the inlets is good, as fish seemed to concentrate at the mouths of the large inlets and runoff streams. The Wilson River below the lake provides good fishing for cutthroat trout 200 to 300 millimeters long.

Wildlife in the area included an abundance of waterfowl--loons, mergansers, bufflehead and goldeneye ducks, and an occasional Canadian honker. Beavers inhabited the main inlet and outlet streams, as evidenced by their dens, cuttings, and dams. Deer sign was scarce. A few tracks were seen in the upper Wilson River, but no deer were sighted. Black bear are known to inhabit the area. Fresh bear tracks were spotted on the beach in front of the Wilson Narrows Cabin. Wolves were spotted near the Wilson River, but none were sighted in the area of the lake.

Duncan Creek and Saltchuck

Duncan Creek (56°46'30" N, 133°14'00" W) flows 11.8 kilometers (7.3 miles) to the head of Duncan Canal. It is located 17.7 kilometers (11 miles) west of Petersburg on the west coast of Lindenberg Peninsula, Kupreanof Island.

Duncan Creek is readily accessible from Petersburg by floatplane or by boat from Duncan Canal. A rock rapids forms a block at the entrance from Duncan Canal during low water. At high tide small boats can be taken over these rapids into the estuary at the delta of Duncan Creek. This rapids is a definite hazard to boaters or pilots who are unfamiliar with the area.

The Duncan Canal Towers Arm-Duncan Creek area is a very popular recreation area. This is a major waterfowl and fishing area with easy access and many facilities.

Duncan Saltchuck has two recreation cabins, a U.S. Forest Service A-frame cabin and an older Dingell-Johnson cabin now maintained by the U.S. Forest Service.

During the period August 8 through 12 a thorough effort was expended to map and fry trap the major portion of Duncan Creek (Figure 21). Figure 22 shows the physical features of tributary No. 1 and locations of fry trap sets 1A through 11A. A summary of fry trap catches is listed in Table 22. Figures 23 through 25 show the portion of Duncan Creek that was mapped.

The most abundant rearing species captured in Duncan Creek were coho salmon, O. kisutch (Walbaum); Dolly Varden; and rainbow trout. Of 682 fish captured in 48 fry traps, 357 were coho salmon, 184 were Dolly Varden, 93 were rainbow trout, and 17 were cutthroat trout.

Duncan Creek and Saltchuck are very important areas for coho salmon. Rearing coho salmon were found throughout the portion of the stream system that was trapped. Rearing coho salmon were observed throughout the lower saltchuck areas. They were very active, feeding on surface insects. No estimate of adult coho salmon escapement was made, but this is a popular coho salmon fishing area. Adult coho salmon were abundant in the saltchuck after mid-August.

The presence of adult steelhead trout has not been confirmed, but the wide distribution of rearing rainbow trout demonstrates the importance of this system.

Dolly Varden were present throughout the system. Several bright anadromous fish were moving into Duncan Creek to spawn in late August. The saltchuck may be an important overwintering area.

Although not many rearing cutthroat trout were captured, the majority of the area fry trapped was not prime cutthroat trout rearing area. No backwater beaver dams or slough areas were trapped. Larger cutthroat trout concentrate in the saltchuck to feed. They were observed in schools near the inlet rapids. This may be an important overwintering area, but this has not been documented.

Stream drift organisms collected from Duncan Canal are summarized in Table 23.

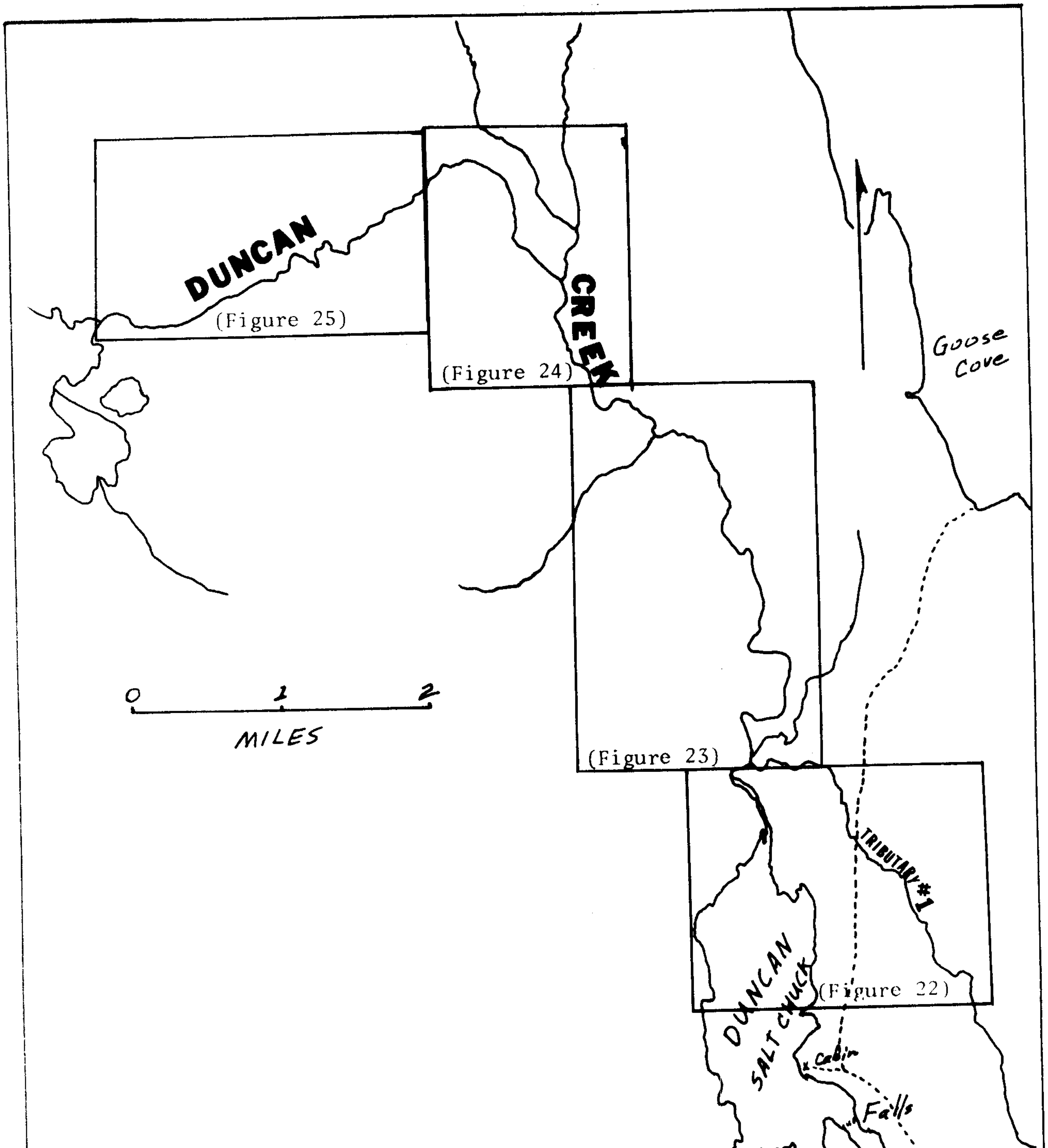


Figure 21. Location map showing portions of Duncan Creek mapped and fry trapped, August 9-10, 1977.

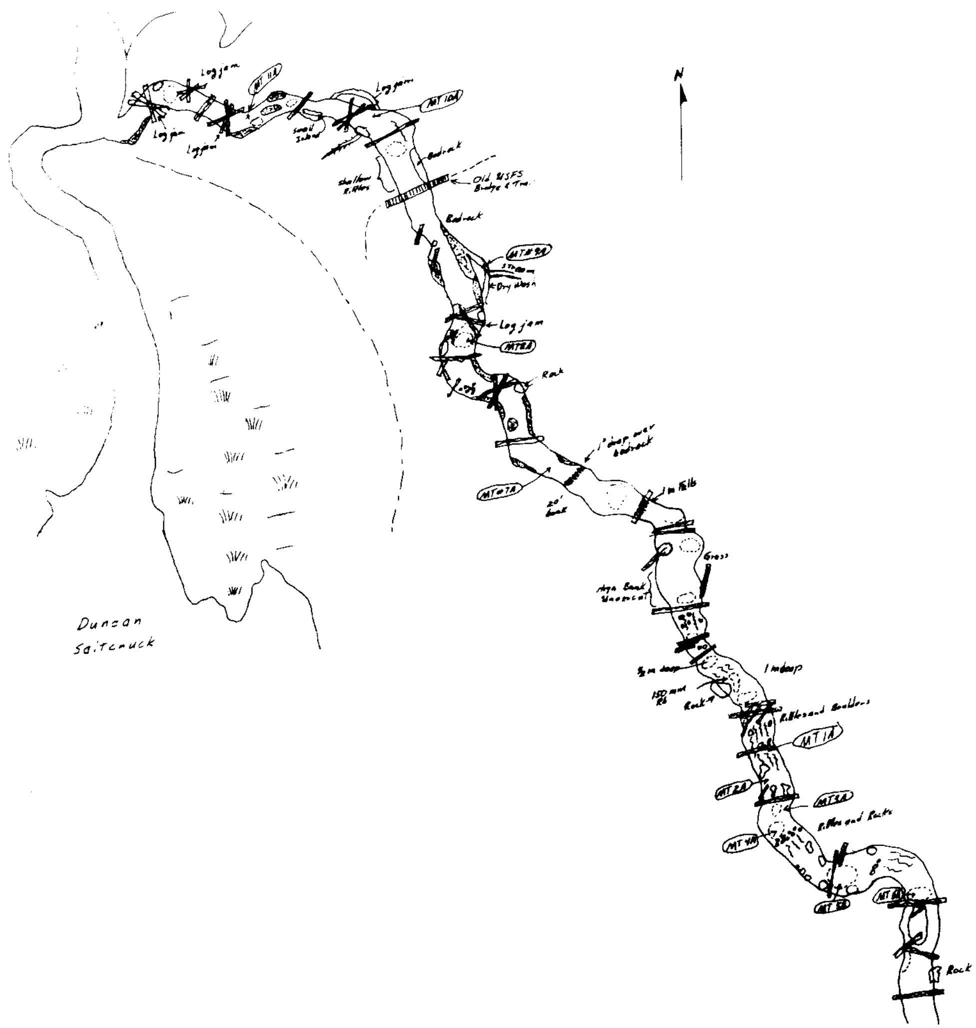


Figure 22. Map showing physical features and fry trap locations of tributary No. 1, Duncan Creek.

Table 22. Summary of fry trap catches from Duncan Creek, 1977.

Set Number	Number of Fish	Coho Salmon	Rainbow Trout	Dolly Varden	Cutthroat Trout	Cottids	Remarks
1	6	1	3	2	0	0	Moderate water - pool.
2	34	33	0	1	0	0	Slow water, log jam - pool.
3	10	4	5	1	0	0	Fast water.
4	10	9	0	1	0	0	Slow water under log.
5	4	3	0	1	0	0	Moderate and deep.
6	61	57	12	12	0	0	Slow and deep.
7	6	6	0	0	0	0	Slow in log jam.
8	0	0	0	0	0	0	Fast - undercut bank.
9	0	0	0	0	0	0	Backwater behind rock.
10	31	30	1	0	0	0	Slow water.
11	5	1	3	1	0	0	Fast water.
12	0	0	0	0	0	0	Pool.
13	10	6	2	2	0	0	
14	6	4	2	0	0	0	
15	29	22	3	4	0	0	
16	68	67	1	0	0	0	
17	9	7	2	0	0	0	
18	27	8	13	6	0	0	
19	77	6	11	60	0	0	Four-foot pool between logs.
20	38	15	11	12	0	0	Side pool - root debris.
21	4	2	0	0	0	2	Four-foot deep riffle.
22	8	4	4	0	0	0	Six-inch riffle.
23	13	1	0	0	0	12	Pool in rapids.
24	9	4	2	1	1	1	Pool by log jam.
25	0	0	0	0	0	0	Pool.
26	39	0	0	39	0	0	Pool.
27	10	2	2	5	0	1	Pool.
28	19	4	0	4	11	0	Channel.
29	8	4	2	0	0	2	Pool.
30	5	4	0	0	1	0	Pool.
31	20	6	0	1	1	12	Pool.
32	31	0	4	25	2	0	Pool.
33	0	0	0	0	0	0	Small pool.
34	2	2	0	0	0	0	Open pool - intertidal.
35	6	6	0	0	0	0	Under log intertidal pool.
36	24	24	0	0	0	0	Pool.
37	1	0	0	0	0	1	Pool by cabin.
1A	2	0	1	1	0	0	Seventy minute set.
2A	2	1	1	0	0	0	Sixty-five minute set.
3A	0	0	0	0	0	0	Fifty-five minute set.
4A	8	4	2	1	1	0	Fifty minute set.
5A	5	2	2	1	0	0	Thirty-five minute set.
6A	12	9	2	1	0	0	Twenty-Five minute set.
7A	0	0	0	0	0	0	Fifteen minute set.
8A	5	5	0	0	0	0	
9A	3	3	0	0	0	0	
10A	1	0	0	1	0	0	
11A	14	11	2	1	0	0	

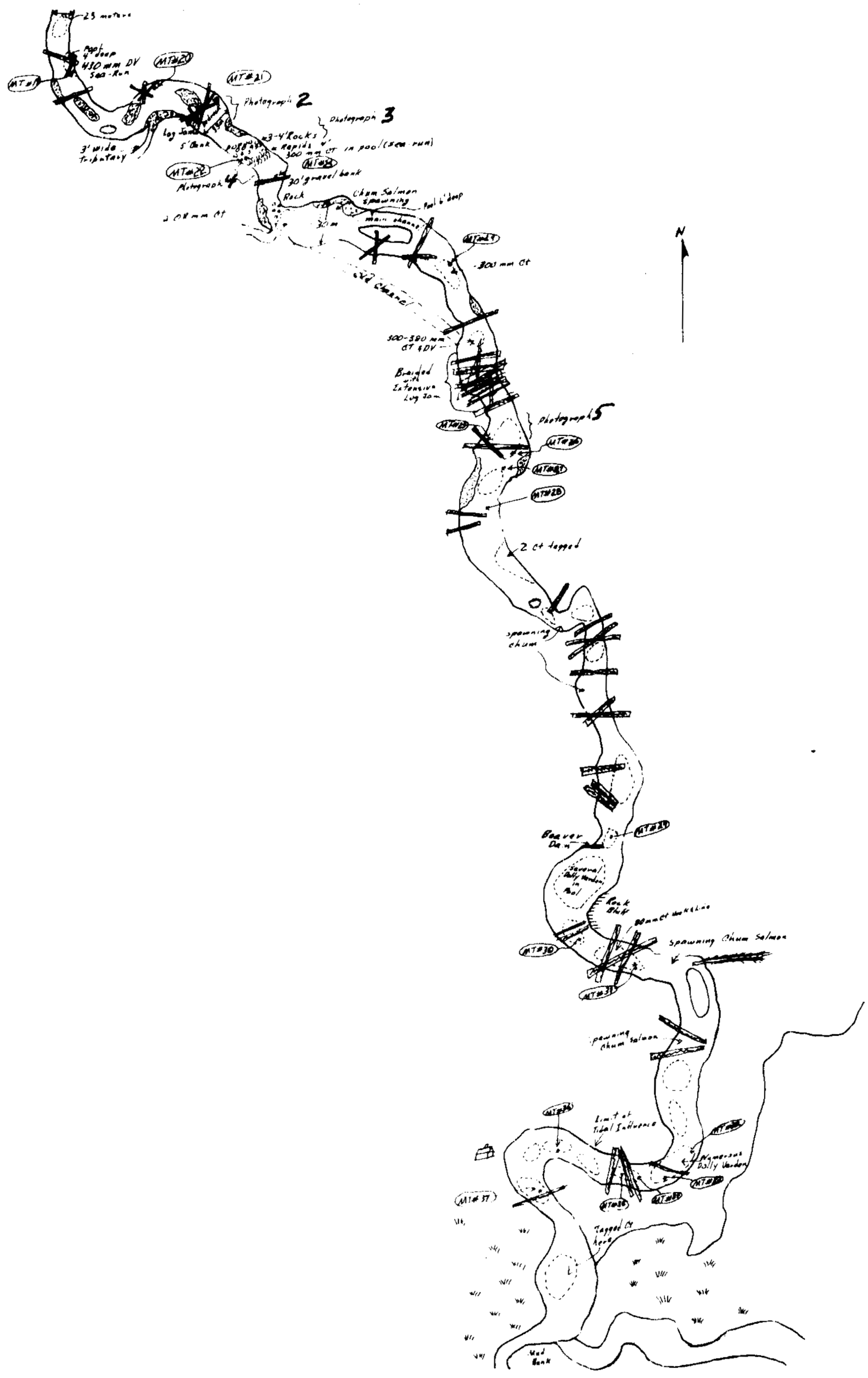


Figure 23. Map of Duncan Creek from approximately mile 0.0 to mile 4.0.

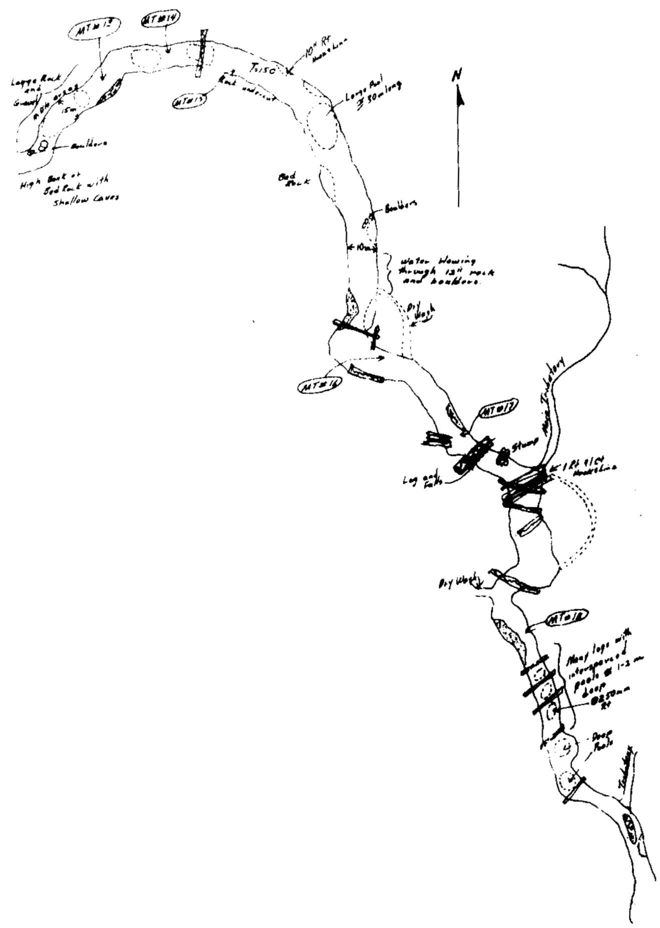


Figure 24. Map of Duncan Creek from approximately mile 4.0 to 6.2.

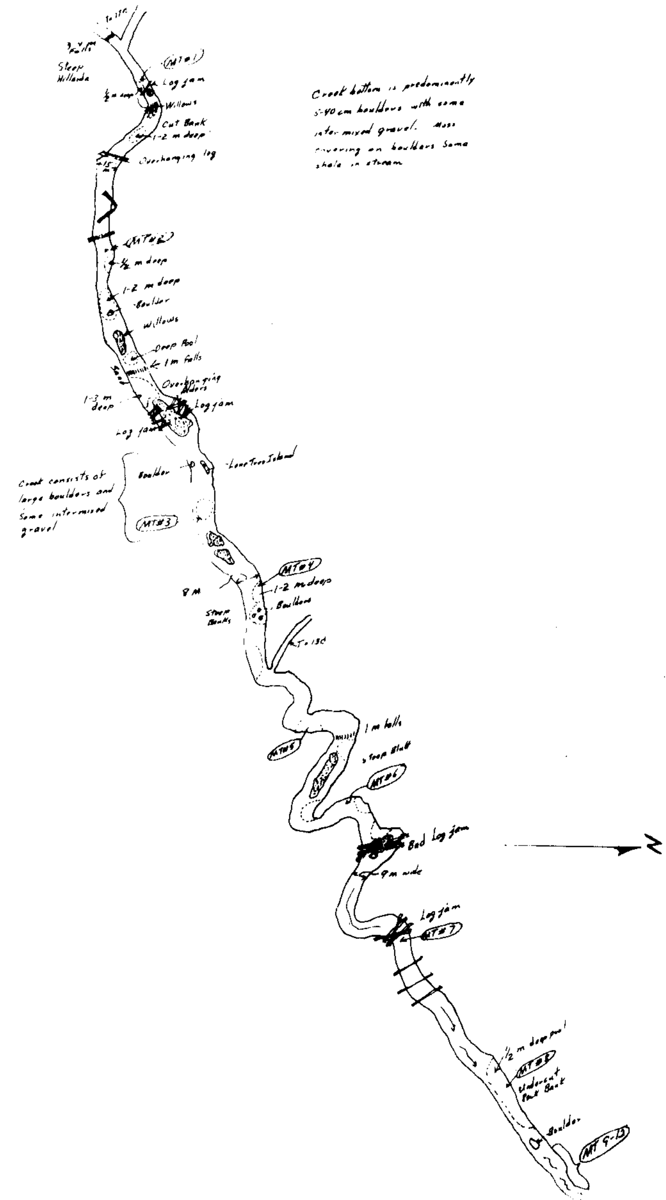


Figure 25. Map of Duncan Creek from approximately mile 6.2 to 9.0.

Table 23. Identification and enumeration of stream drift organisms from Duncan Creek, 1977.

Date	August 10		August 11
Net Number	1	2	1
Hydracarina	13		11
Insecta			
Ephemeroptera			
Baetis bicaudatus	5		
B. intermedius	30	28	
B. tricaudatus	2	20	
Cinygmula sp.	2	1	
Ephemerella sp.	2	4	
Paraleptophlebia debilis		1	
Plecoptera			
Alloperla sp.	2	1	1
Capnia sp.			11
Leuctra sp.		1	
Trichoptera		1	
Limnephilidae	2	2	1
Diptera			1
Chironomidae			
(Adults and Pupae)	3		
(Larvae)			
Tanypodinae	1		1
Tanytarsini			2
Orthocladius sp.			8
Empididae			1
Simulidae	1		
Collembola	1	1	1
Coleoptera		1	
Dytiscidae			1

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